The Dissemination and Implementation of the Back Skills Training Trial (BeST)

By

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Declaration

This thesis is my own work, including the development of an online training programme (chapter 3) and the sole set up, management of and data collection for the mixed methods evaluation in this thesis (chapters 4-8) with the following exceptions:

- The randomisation sequence generation (detailed in chapter 6) was carried out by Dipesh Mistry (Statistician).
- Technical assistance to set up the online training programme was provided by Andrew Williamson (computer programmer).
- The face-to-face training that formed the control intervention in the randomised controlled trial (detailed in chapter 6) was delivered by Dr Zara Hansen (cognitive-behavioural physiotherapist).

This thesis has not been submitted for a degree at another university.

Abstract

Effective management of low back pain (LBP) is a worldwide health concern. The Back Skills Training Trial (BeST) demonstrated the clinical and cost-effectiveness of a cognitive behavioural (CB) approach for non-specific low back pain. Uptake of such evidence into routine clinical practice is problematic. Provision of training presents an early challenge in the implementation process. Online training has the potential to enable greater access at reduced costs. This thesis aimed to establish the potential efficacy and acceptability of an online training implementation strategy for providing physiotherapists with the skills required to implement BeST within the NHS.

Following a systematic review investigating the effectiveness of online learning among health professionals, a comprehensive online training programme (i-BeST) was developed to train physiotherapists in BeST. Mixed methodology was used to evaluate i-BeST consisting of an exploratory randomised controlled trial (n=35) comparing i-BeST to face-to-face training, and concurrent semi-structured interviews (n=13) to explore the acceptability of receiving the BeST training online. Quantitative and qualitative data were analysed separately and integrated during the discussion of this thesis.

Implementation of the BeST intervention was low (n=12) and did not differ significantly between groups. Online participants were sceptical about the plausibility of learning through online methods. Despite these reservations, all participants reported a positive impact of the training on their clinical practice; however both groups showed anxiety around adopting a CB approach. This thesis identified a number of important barriers to the implementation of BeST ranging from factors associated with the physiotherapists themselves, to the adaptability of the BeST intervention and organisational/cultural factors. Future implementation strategies need to address these barriers and enhance support for physiotherapists adopting a CB approach. This may be challenging in resource constrained services.

List of abbreviations

BeST – Back Skills Training intervention

BSREC – Biomedical and Scientific Research Ethics Committee

CB – Cognitive behaviour

CBT – Cognitive behavioural therapy

CI – Confidence interval

CONSORT – Consolidated Standards of Reporting Trials

CTS-R-Pain – Cognitive therapy scale - revised - pain

CRF - Clinical report forms

DOH – Department of Health

EPOC – Effective Practice and Organisation of Care

FA – Framework analysis

GT – Grounded theory

HC-PAIRS - Health Care Provider's Pain and Relationship Scale

HOE – Heart of England NHS Foundation Trust

JISC – Joint Information Systems Committee

LBP – Low back pain

MCQ – Multiple choice questions/questionnaire

MRC – Medical research council

NAT – Negative automatic thought

NHS – National Health Service

NICE – National Institute for Health and Care Excellence

OSCE – Objective structured clinical examination

PABS-PT – Physiotherapy Attitudes and Beliefs Scale

PRISMA - Preferred Reporting Items for Systematic Reviews and Meta-Analyses

RCT – Randomised controlled trial

RD and I – Research, development and innovation

ROH - Royal Orthopaedic Hospital NHS Foundation Trust

SD – Standard deviation

SE – Self-efficacy

SG – Small group

SMD – Standardised mean difference

SOP - Standard operating procedure

SWB - Sandwell and West Birmingham Hospitals NHS Trust

SWFT - South Warwickshire Foundation Hospital Trust

TA – Thematic analysis

UHCW - University Hospitals Coventry and Warwickshire NHS Trust

UK – United Kingdom

VLE – Virtual learning environment

WCTU - Warwick Clinical Trials Unit

YDL – Years lived with disability

Chapter 1 - Introduction

This chapter will discuss the problem of low back pain, the evidence for cognitive behavioural programmes and provide a description of the BeST intervention. Following this, the importance of implementation research to improve the management of this patient population will be discussed before concluding with a consideration of different implementation strategies and the current evidence base behind them.

1.1 Background of LBP

Low back pain (LBP) is a significant global health problem that most people will endure at some point in their lives (1). Within the UK, LBP has an estimated lifetime prevalence of 49% to 80% (2) while globally, estimates of one year prevalence range from 0.8% to 82.5% (3). It is the most common form of chronic pain and in the UK alone accounts for 37% of all chronic pain in men and 44% in women (4). The most recent Global Burden of Disease study shows that LBP is the leading cause of Years Lived with Disability (YLD) in all developed countries and the second largest contributor to disability globally, resulting in 83.1 million of YLD's (5). The financial burden of LBP is equally vast, with estimates from 2000 suggesting that LBP cost the UK economy over £12 billion in direct (£1632 million) and indirect costs (£10668 million; (2). More recently, Hong et al (6) estimated the direct costs to have risen from this earlier estimation of £1632 million, to a staggering £2.8 billion, suggesting that the indirect costs will have also increased significantly. Consequently, LBP represents an enormous worldwide health problem, exerting substantial costs to the individual, society and the economy.

Importantly, the Global Burden of Disease 2010 study highlighted the growing prevalence of chronic disability, primarily as a result of increasing longevity, and anticipated that this trend will continue to increase (7). Therefore, effective management of LBP is a major

concern with regard to quality of life and socio-economic costs and as such, LBP is a National Health Service (NHS) research priority in the UK (4). Both within the UK and globally, substantial amounts of time and money are devoted to scientifically evaluating optimal treatment strategies for LBP (8, 9). Synthesising this evidence base, the National Institute for Health and Care Excellence (NICE) produced a clinical guideline for the management of persistent (more than six weeks duration) non-specific LBP which recommended the following treatments: advice, exercise, manual therapy and acupuncture (10).

This guideline is currently under review and, in its present form, stipulates that there is inconclusive evidence regarding the effectiveness of cognitive behavioural therapy (CBT) for persistent LBP, advocating that future research develop this promising field (10). Since the publication of these guidelines, there has been continued recognition in the importance of psychological and social factors in both the development and maintenance of persistent LBP and for treatment strategies to address these factors (11-13). Additionally, there has been increasing empirical evidence supporting the use of cognitive-behavioural treatment strategies for the management of persistent LBP (14-17), and persistent pain more generally (18). Cognitive-behavioural treatment approaches are also one of the most cost-effective treatments available for LBP to date (19). Thus, with a now substantial evidence base, cognitive behavioural treatment strategies are widely accepted and recommended for implementation among patients with persistent LBP (20-23).

1.2 The importance of implementation research

The output of research itself cannot influence patient outcomes unless it is utilised by organisations and implemented by health care professionals (24). A consistent finding in the literature is that research evidence is frequently not implemented into clinical practice,

leaving a large gap between the current evidence base and standards of clinical practice (8, 25-27). The Global Burden of Disease 2010 study (7) noted the availability of evidence-based treatments for musculoskeletal disorders and questioned the extent to which these interventions were being implemented in this important and growing population. Numerous theories and frameworks have been proposed to explain the knowledge to practice gap (28-30). One consensus amongst this literature is that the transfer of research into clinical practice is a wide ranging, complex and multifaceted process, starting with the attributes of the research evidence itself (31), through to the individuals and the organisations where implementation should occur (25, 32, 33). Regardless of the many potential explanations in the literature, frequent failure to translate research into clinical practice negatively impacts upon patient care, ultimately denying patients effective evidence based interventions (9, 34).

Over the past decade there has been growing interest in the field of implementation research, with acknowledgement of its critical role in bridging the research-practice gap (8, 24). The Clinical Effectiveness Research Agenda Group (CERAG) defines implementation research as:

"…the scientific study of methods to promote the systematic uptake of clinical research findings and other evidence based practices into routine clinical practice, and hence improve the quality of health care. It includes the study of influences on healthcare professional and organisational behaviour." (24) (page2)

In 2011, the UK Department of Health (DOH) identified the adoption and diffusion of research as a key priority in the NHS and outlined a comprehensive, challenging plan to bring advances in health care innovation to the patients it serves (35). This supports the aim of this thesis, which was to explore the implementation of an evidence based

cognitive-behavioural treatment for the management of persistent LBP patients (the 'BeST' intervention; (14)). Before this introduction moves forward to discuss strategies for achieving implementation, a description of the BeST intervention is provided to set the context of this thesis.

1.3 Description of the BeST intervention

The Back Skills Training intervention (BeST) has a published description (36) and evidence-base for its effectiveness (14, 37-39). BeST is a group-based intervention that utilises a cognitive behavioural approach for the management of persistent LBP, and was developed by a team of cognitive behavioural and physiotherapists. Although intended for broad use in nursing, allied health and psychological professions, the thesis concentrates on physiotherapists, as these are the primary care providers for LBP in the NHS (2). The intervention consists of an individual assessment (of up to 1.5 hours duration) and 6 times 1.5 hour group sessions, with an optimal target of 8 patients per group (14, 36). BeST is a manualised, structured intervention; it provides therapists with detailed guidance for the individual patient assessment and scripted narratives for each group session. Therapists are asked to adhere to the manual to ensure the delivery of a standardised intervention. The assessment and six group sessions are detailed below to provide some background to their content:

Individual Assessment

This one-to-one assessment aims to understand the patient's back problem from their perspective and to identify any issues which may be obstacles to recovery. The concept of the CB intervention is explained to patients and their initial goals for the programme are discussed. Exercises are set collaboratively. The assessment does not aim to establish their range of movement or strength; nor to ascertain any mechanical of physical abnormalities.

Group Session One

Session one consists of pain education to improve patients understanding of chronic pain and aims to challenge the notion that pain always equates to harm. The session also asks patients to identify the effects of inactivity and to contrast these against the effects of exercise with the aim of helping patients to understand the importance of activity. The session concludes with a discussion around their early goals and gives homework to identify three personal goals.

Group Session Two

This session introduces the concept of negative activity cycling, where activity levels are reduced when the individual is in pain. Identifying this cycle of behaviour aims to help patients learn that using their pain levels to manage their activity is not very helpful, since it reinforces the link between activity and pain, and results in a steady decline of activity over time. The session then teaches patients three skills to try and break the pattern of negative activity cycling: baseline setting (determining their average capability for an activity over good and bad days), pacing (producing a plan that is adhered to over both good and bad days) and goal setting (breaking goals down into small achievable steps). Session two concludes with homework to break down their three goals into small steps.

Group Session Three

This session introduces the importance of thoughts and feelings in the maintenance of LBP. The session teaches patients how to identity negative thoughts relevant to their LBP and shows patients how these thoughts influence their feelings, which drive their behaviour. Patients are then taught strategies to challenge these thoughts with the aim of producing an alternative thought or way of thinking. The session concludes by showing the patients how thoughts and

feelings link into all aspects of their ongoing LBP, and asks them to practice this process of identifying and challenging negative thoughts for homework.

Group Session Four

Session four introduces the role of fear avoidance, where pain causes avoidance of particular activities or movements, and helps patients to discover that this avoidance may exacerbate and maintain their LBP. The session problem solves how patients might restart feared movements or activities and recaps on the principles of baseline setting and pacing from session two. The session concludes by teaching and practicing two relaxation techniques (deep breathing and stretch-relax). Their homework from the session includes a plan on how to restart a feared activity and to practice both relaxation techniques.

Group Session Five

This session introduces the topic of hypervigilance and discusses the effects of worrying about pain. The hypervigilance cycle states that worrying about pain, draws attention to pain. This can result in feelings of concern or anxiety, leading to protective behaviours which, in turn, maintain the experience of pain. Strategies to draw attention away from pain are discussed and medication is reviewed at this point. The session concludes with two further relaxation techniques (visualisation and autogenic relaxation), and stipulates homework to recap all sessions to identify any areas they would like to revisit in the last session.

Group Session Six

This session discusses the cyclic nature of LBP. The therapist and patients arrive jointly at a strategy to cope with future flare ups. The patients identify any other topics to revisit, following which the session and the intervention is completed.

1.3.1 Integrating a CB approach into physiotherapy practice

Delivering the BeST intervention requires physiotherapists to adopt a cognitive behavioural (CB) approach. The integration of this approach into physiotherapists' clinical practice has been postulated to present a number of challenges (20, 21). The first challenge in the adoption of this approach is the dominance of the biomedical paradigm within physiotherapy education and clinical practice (40). Research has shown that physiotherapists typically perceive LBP to be largely structural or mechanical in nature, with treatment strategies aimed at managing these physical symptoms (20, 41). In contrast, a CB approach is based within the biopsychosocial paradigm, which recognises the individual as a whole, and acknowledges the importance of psychological factors and social context in the experience of pain (22, 40). Therefore, adopting a CB approach for the management of LBP requires a philosophical shift in physiotherapists' attitudes and beliefs towards LBP (20).

Secondly, in order to utilise a CB approach, physiotherapists are required to change their style of treatment delivery. The therapeutic style moves away from the traditional didactic mode of delivery, where the physiotherapist dictates to the patient, to a more discursive style. This requires the therapist to work with the patients as more of a facilitator rather than as a dictator and may challenge the traditional role of the physiotherapist in the therapeutic relationship (21, 42). Thirdly, the use of a CB approach and a discursive therapeutic style require the therapists to learn a number of new skills that do not fall within their immediate scope of practice (21). This includes: the use of a new style of communication and questioning, behavioural change strategies, the identification of relevant cognitions and the skill to challenge these cognitions (thought challenging). Therefore, the integration of a CB approach in physiotherapists' clinical practice represents both a philosophical and practical change towards their management of LBP patients (20).

1.4 Implementation strategies

An essential component to the implementation of evidence into clinical practice is the provision (access, availability and quality) of training for health care professionals, providing them with the knowledge base, skill set and self-efficacy to effectively deliver evidence-based treatments (25, 43, 44). This is particularly important considering the additional knowledge and skills that are required to deliver the BeST intervention that are not taught within traditional physiotherapy education (20). There are two implementation strategies identified by the Cochrane Effective Practice and Organisation of Care group (EPOC) that would be suitable for providing clinicians with the knowledge and skills to deliver the BeST intervention. The first, dissemination of printed materials, has only limited effectiveness when used in isolation (45). The second strategy, educational meetings, incorporates a range of activities from attending a training course to a conference, and has been shown to exert a small improvement in professional practice and patient outcomes (46). However, the authors noted that when used alone, the strategy was unlikely to change complex behaviours, such as those required to deliver the BeST intervention (46). Therefore, combining both strategies may yield greater changes in professional practice, utilising printed educational materials, such as the BeST intervention manual, along with a training workshop or course (8, 47).

The current 'gold standard' for delivering this combined educational strategy consists of face-to-face workshops, supplemented with manuals and clinical supervision (48). However, delivering training in this form requires a considerable amount of time and resources and therefore incurs high economic costs (43, 49). The potential 'reach' of this training method is also limited, with factors such as geographical location, limited capacity (spaces), funding and resources limiting access this method of training (50, 51). Therefore, the wider dissemination of the BeST intervention training provided many challenges to the

research team who developed BeST. Firstly, only one individual was trained with the necessary expertise to deliver the BeST training, challenging the extent that the training could be more widely administered. Additional professionals could have been trained to deliver the training, using a train the trainer model of dissemination (44), to overcome this first challenge. However, this strategy in itself would be costly and would have required a considerable amount of time (44). Thus, providing face-to-face training on a wider scale required substantial costs to pay both the trainer/s and to source training venues. There is a widely acknowledged lack of funding for dissemination and implementation activities (24, 28), raising the question as to how the large scale delivery of the BeST training with face-to-face methods would be funded. Lastly, the research team behind the BeST intervention were both limited in the time they could devote to BeST dissemination and implementation activities, advancing onto other funded research projects and dispersing geographically with career progression.

As evident from the challenges detailed above, delivering the BeST training with face-to-face methods was not feasibly scalable to achieve wider implementation of BeST. Therefore, an alternative training strategy was essential to scale up the dissemination of the BeST training. The use of online training programmes has been growing in popularity over the past decade, offering potential advantages over traditional face-to-face teaching (49, 52). Online training may provide greater access to training without the constraints of limited spaces and geographical boundaries (53). In addition, this method of training may reduce the economic costs associated with face-to-face training methods for both the training provider and for the individual health care professionals (43, 53). Furthermore, online training is not dependent on management granting full days of study leave, and may allow health care professionals to engage in training at times and locations convenient to them (53). However, there is concern over users' ability to learn clinical skills with online

methods, as well as apprehension around the potential detrimental effects of learning in isolation(51, 54). Additionally, despite reports of comparable efficacy to face-to-face training interventions (49), there is a scarcity of research evaluating online interventions for training health care professions in complex interventions, such as BeST.

1.5 Thesis aims

This thesis aimed to explore the implementation the BeST intervention into physiotherapy practice for the management of persistent LBP. This exploration began with the design and production of an innovative online training package (i-BeST). From here, this thesis aimed to explore the efficacy of training physiotherapists to deliver the BeST intervention with i-BeST in comparison to traditional face-to-face training. Hence, this thesis aimed to answer the following research questions:

1) What is the evidence base for the effectiveness of online interventions for training health care professionals in complex interventions?
2) What is the efficacy of an online course (i-BeST) compared to face-to-face methods for training physiotherapists in the BeST intervention?

To answer these research questions, this thesis reports:

- A systematic literature review of the effectiveness of online training for health care professionals working in a health care environment.
- The methods used and the processes involved in the development of an online training programme (i-BeST).
- A mixed methods evaluation of i-BeST consisting of:
    - A randomised controlled trial to explore the efficacy of i-BeST compared to traditional face-to-face training across a range of outcome measures.

- An assessment of participants' use of and engagement with i-BeST through analysis of learner analytics.
- An exploration of physiotherapists' experiences of learning with i-BeST using qualitative methodology.

Chapter 2 - A systematic review of online learning for training health care professionals to deliver a clinical intervention

2.1 Introduction

As a starting point for this thesis it was necessary to conduct a review of the literature to ascertain whether an online training programme was a viable option for training physiotherapists in the BeST intervention. A systematic literature review was selected over a narrative review for a number of reasons. Firstly, narrative reviews may fail to identify all relevant evidence since they do not have to use a comprehensive search strategy (55). Secondly, since no formal methods are employed in narrative reviews, they are subject to bias at a number of stages and therefore, may not be accurate and reproducible (56). By contrast, systematic reviews utilise predefined, scientifically rigorous and objective methods to ensure repeatability and limit bias (57). Thus, a systematic literature review was the most appropriate methodology to evaluate the effectiveness of online training.

In the most recent and comprehensive systematic review, Cook et al (49) reviewed 201 articles (published between 1991-2008) evaluating the effectiveness of Internet based learning for health professionals. None of the studies in this systematic review included physiotherapists. The pooled effect sizes from meta-analyses of online learning compared to alternative interventions suggested that there were no differences in learner satisfaction: SMD (95% CI) 0.10 (-0.12, 0.32); learner knowledge: SMD (95% CI) 0.065 (-0.062 to 0.19), learner skills: SMD (95% CI) 0.09 (-0.26, 0.44); and learner behaviour: SMD (95% CI) 0.51 (-0.24, 1.25). Particular intervention design factors were found to have significant interaction effects, with discussion and longer courses improving knowledge outcomes and behaviour, and higher interactivity improving skills. The authors concluded

that online learning was educationally beneficial and that it could achieve similar results to traditional, non-internet instructional methods.

Following on from their earlier systematic review, Cook et al (53) conducted a further systematic review to identify which design features of online interventions enhanced outcomes of satisfaction, knowledge, skills and clinical practice (patient effects). They identified 51 eligible studies (published between 1991-2008) that evaluated the use of two online interventions with identical content where specific design features were varied, such as, the degree of interactivity (see Table 1 for a definition). Fifteen studies investigated the effect of varying degrees of interactivity on learning outcomes, producing a pooled effect size (SMD) in favour of interactivity of 0.27 (95% CI 0.08, 0.46). Practice exercises (defined in Table 1) were evaluated in ten studies and yielded a favourable pooled effect size (SMD) on learning outcomes of 0.4 (95% CI 0.008, 0.71). The use of feedback could only be isolated in two studies with a pooled effect size (SMD) on learning outcomes of 0.68 (95% CI 0.01, 1.35) in favour of feedback. Online discussion (defined in Table 1) was found to improve learner satisfaction only (SMD 0.32, 95% CI 0.14, 0.51).

Table 1. Definitions used by Cook et al (48; p1183) for each specific design feature

Practice exercises
Included cases, self-assessment questions and any other activity where a learner had to apply information they had learnt.
Cognitive interactivity
Referred to the level of cognitive engagement required for course participation. Multiple practice exercises equated to higher levels of interactivity. Essays and group collaborative projects also constituted higher levels of interactivity.
Discussion
Provision for synchronous or asynchronous peer-peer or instructor-student interaction through the use of: discussion boards; emails; chat; or internet conferencing.

In summary, the review suggests that learner satisfaction can be enhanced though interactivity, online discussion and the use of audio tutorials; whilst learning outcomes can

be enhanced through the use of interactivity, practice exercises, feedback and repetition. However, heterogeneity was high in all of the meta-analyses (I^2 ≥89%), many of which were small and contained as few as two studies. Due to the small numbers and wide variation within each meta-analysis with regards to intervention definitions, control interventions and study designs, there are limited inferences that can be drawn from the results (58). Thus, further research is needed to assess the effect of particular design features on learner outcomes and satisfaction.

Rationale for conducting this systematic review

In the systematic review by Cook et al (49), individual study effect sizes were inconsistent and the pooled effect sizes were derived from studies with high heterogeneity due to the deliberately broad inclusion criteria. The included studies were of varying methodological quality (from single group pre-post designs to RCTs) and the authors included blended interventions in the online training category (combined online and face-to-face methods). The population inclusion criteria were also very wide, defining health care professionals as students, postgraduates or practitioners in a field related to human or animal health (49). Along with this high heterogeneity, many of the included studies did not aim to train participants in clinical skills and only six studies evaluated the effects of training on clinical behaviour. Thus, the applicability of the pooled effect estimates to training employed health care professionals in a complex clinical intervention for patients is difficult to ascertain.

Wong et al (59) express the importance of the specific context the online course is to be delivered in (in this instance, physiotherapists working within the NHS), since successful outcomes are a function of course-context interaction, rather than simply a result of the course content on its own. Therefore, the results from the systematic review by Cook et al (49) cannot provide information regarding the effectiveness of online learning for training

health professionals working within a health care environment. In particular, their results have limited scope to inform on the effectiveness of online training for complex interventions that require health care professionals to shift their attitudes and beliefs and to learn new skills based in a paradigm outside of their immediate scope of practice. Therefore, there is a need to systematically review the literature concerning the effectiveness of online/computer-based training using stricter and more specific inclusion criteria to provide more accurate and valid estimates of effects in this population.

2.2 Aims

The primary aim of this systematic review was to determine the effectiveness of online/computer-based learning for training health care professionals, working within a health care environment, in the knowledge and skills required to deliver a clinical intervention, in comparison to traditional non-computer educational methods, such as face-to-face teaching. The secondary aim of this review was to explore which components of online interventions were associated with greater effectiveness.

2.2.1 Objectives

- Relevant literature was identified through a comprehensive search strategy across a range of databases.
- Studies were assessed for eligibility according to pre-set criteria.
- The included evidence was evaluated for methodological quality.
- Sources of heterogeneity among the included studies were identified and discussed.
- Intervention effect sizes were calculated
- A narrative synthesis of the evidence was produced.

- Intervention components were assessed and compared.

2.2.3 Research Questions

1. Are online/computer-based learning interventions as effective as traditional (non-computer) educational interventions for training health care professionals with the knowledge and skills to deliver a clinical intervention?
2. What components of an online/computer-based learning programme enhance health care professionals learning with regard to knowledge, skill and clinical behaviour?

2.3 Methods

The methods and results detailed in this systematic review follow the latest guidance and draw on the Cochrane Handbook of Systematic Reviews for Interventions (60) and the PRISMA guidance for reporting systematic reviews (57).

2.3.1 Eligibility criteria

Types of studies

Only randomised controlled trials (RCTs) investigating the effectiveness of online interventions for health care professionals were included in this review. RCTs were defined as an experiment where two or more interventions were compared through the random allocation of participants (56). Experiments were considered to be randomised if participants were allocated prospectively to the different intervention arms at random, with a known (and equal) chance of being assigned to a given group (56, 61) . As advised in the Cochrane handbook for systematic reviews of interventions, experiments using quasi-randomisation were also included (60).

Types of participants

- Health care professionals (defined as practitioners in a profession directly related to human health, for example, occupational therapists, medics, physiotherapists

and dentists). Although this thesis focused on physiotherapists, none of the 201 studies included in the broad systematic review by Cook et al (49) included physiotherapists and therefore, the decision was made to broaden the inclusion criteria to health care professionals.

- Working, at least part time, in a health care environment.

Alternative learners in fields un-related to health care, such as physics, were excluded since the interventions taught to health care professionals are not only different in topic and in learning objectives to those in other fields of study; they also require the learner to apply learnt knowledge and skills in the clinical setting (53).

Health care learners not in full time employment, for example, students studying a health care profession, were excluded since this population is governed by different factors with regards to learner needs, dynamics and constraints. Populations from any geographical location were included.

Types of interventions

Online interventions have wide ranging definitions; for this review they were defined as follows:

Computer-based intervention: instruction where 'computers play a central role as the means of information delivery and have direct interaction with the learner' (49) without the use of a live teacher.

Online instruction: 'computer-assisted instruction using the Internet or a local intranet as the means of delivery' (53).

Only interventions relating to or involved with clinical practice were included. Studies using computer simulation or simulation devices were excluded since limited economic resources

would prevent this method of training being used in wide-spread dissemination of the BeST intervention.

Types of comparison

Randomised controlled trials comparing online/computer-based interventions with non-computer based educational interventions were included. Studies comparing the online/computer-based intervention to no active intervention control were excluded, since this review aimed to determine the relative effectiveness of online/computer-based interventions in comparison to alternative methods.

Types of outcome measures

A popular approach to the evaluation of training is the four level hierarchical model proposed by Kirkpatrick (26, 62-64). Level one (reactions) is concerned with the assessment of participants' reactions to the training programme, such as their satisfaction or perceived relevance of the course. Level two (learning) refers to quantifiable indicators of learning as a result of the training, such as knowledge. Level three (behaviour) denotes the extent to which the knowledge and skills gained in training are applied in practice, for example, clinical behaviour. Lastly, level four (results) refers to the impact of the training in relation to the overall training objectives, in this case, patient outcome measures (62). Therefore, the following outcomes were included:

- Satisfaction (level one): assessment of participants' reactions to and satisfaction with the training.
- Knowledge (level two): assessment of subjective (for example, a learner's self-report) or objective (for example, a multiple choice questionnaire, MCQ) knowledge and/or understanding (49).
- Skills (level two): Subjective (for example, observation) or objective measures of learners' ability to practice/deliver the intervention/treatment (49).

- Behaviours (level three): Subjective or objective measures of health care professionals' behaviour in clinical practice.
- Patient outcomes (level four): Subjective or objective measures of patients' health, for example, self-reported well-being. None of the included studies reported level four outcome measures.

2.3.2 Information sources

Relevant studies were identified through the following strategies:

- An electronic search of studies from the year 2000 to October 2011 in the following databases: MEDLINE (Ovid); CINAHL (Ovid); EMBASE (Ovid); AMED (Ovid); Pedro (physiotherapy evidence database); The Cochrane Library and ASSIA (CSA).
- Hand searching reference lists of relevant articles and reviews for additional RCTs.

2.3.3 Search strategy

The following search terms were used in all database searches: computer-assisted instruction/training, Internet, Internet training, user-computer interface, e-learning, distance education, online training, webct, blackboard, wbl, cbl, cai, cal, web-based instruction; web-based learning; health professional and health occupations (example search strategy in appendix 1).

2.3.4. Study selection

The title and abstracts retrieved from the searches were screened by two authors for the following criteria: participants were practicing health care professionals (i.e. not students) and that the intervention was a type of online or computer based training. Full text articles for studies meeting these criteria were obtained and again screened by two authors. The eligibility assessments were not blinded. Disagreements were resolved though discussion.

2.3.5 Data collection (PICO and results)

Extracted data was recorded on a pre-developed form (appendix 2). The following descriptive information was recorded: the number of participating health care professionals, gender ratio, mean age (years), nationality, level of training (experience) of the participants, inclusion/exclusion criteria, the intervention (medium for delivery, use of engaging technology, degree of learner support, components, pedagogical approach and use of psychological theory), aim and subject of training/course, details of control intervention, outcome measures (including outcome data at baseline and follow-up when available, including mean (SD) or n (%) as reported for: knowledge, skills, behaviours, satisfaction, patient effects, engagement with intervention and psychological mediators), length of follow-up, fidelity, participant adherence and economic information.

2.3.6 Risk of bias

Studies were assessed for bias using the risk of bias criteria developed by the Cochrane Collaboration (60), adapted by the Effective Practice and Organisation of Care group (EPOC) to address three additional domains assessing design specific threats to validity (65). Recent systematic review guidelines recommend using a component approach when conducting assessment of bias where each component has a good empirical evidence base (57). The criteria detailed below have extensive support from evidence and have been shown to be valid when evaluating studies from diverse clinical areas (57). Individual criteria that studies were assessed on were:

- Sequence generation (did the study report a random component to the sequence generation).
- Allocation concealment (was the allocation concealed or performed by institution).
- Baseline outcome measurements (were baseline outcome measures for the intervention and control groups reported and if so, were they similar).

- Baseline characteristics (were baseline characteristics for the intervention and control groups reported and if so, were they similar).
- Completeness of outcome data (if there were missing data, was it likely to have biased the results).
- Blinding of primary outcome assessment (was the primary outcome variable assessed blindly).
- Protection against contamination (was it unlikely that the control group received the intervention).
- Selective outcome reporting (were all relevant outcomes detailed in the methods section reported in the results section).
- Other risks of bias (was there any evidence of any other sources of bias).

2.3.7 Summary measures of effect

For each outcome of interest and for each study, a summary measure of effect was calculated. Where possible, the effect measure for continuous data was the standardised mean difference (SMD), defined as a measure of the intervention effect in each study relative to the variability observed in that study (60), with 95% confidence intervals (CIs). This measure of effect was selected as it enables comparison of results that would otherwise not be directly comparable due to, for example, the use of different measurement scales (57). SMDs were calculated using Review Management software, RevMan (56).

2.3.8 Planned method of synthesis

Before considering the method of synthesis, the heterogeneity of the included studies needed to be assessed. The PRISMA statement describes heterogeneity as variability between study results in excess of that due to chance, reflecting true differences in the study results (57). Heterogeneity can arise from clinical, methodological and statistical

aspects of the included studies (57, 60). When looking at the studies included in this review, they differed substantially with regards to the participants, interventions (topic, type and time), comparator groups and outcome measures (type and time). Whilst all of the studies investigated a form of online learning, the components, content, subject and time of the online learning interventions varied greatly between the studies. The degree of clinical and methodological heterogeneity between the included studies was considered and discussed by both reviewers (Helen Richmond and Chris Bridle) and a joint decision was made not to combine the individual study results in meta-analyses. Combing studies with high heterogeneity can result in misleading and meaningless effect sizes (58, 60). Therefore, the studies were summarised and narratively evaluated with regard to key outcome measures:

- Learner knowledge (subjective or objective assessments of factual or conceptual understanding).
- Practice skills (subjective or objective measures of practical skills).
- Learner satisfaction (Self-reported satisfaction with the course/training).

2.3.9 Additional analyses

The influence of specific design features (use of feedback, degree of interactivity, online discussion, audio, repetition, and practice exercises) on effect estimates could not be investigated beyond making qualitative inferences due to poor reporting of the interventions and study results. Thus reducing the number of studies where effect sizes could be calculated and, in a number of studies, precluding the identification of which intervention components were used.

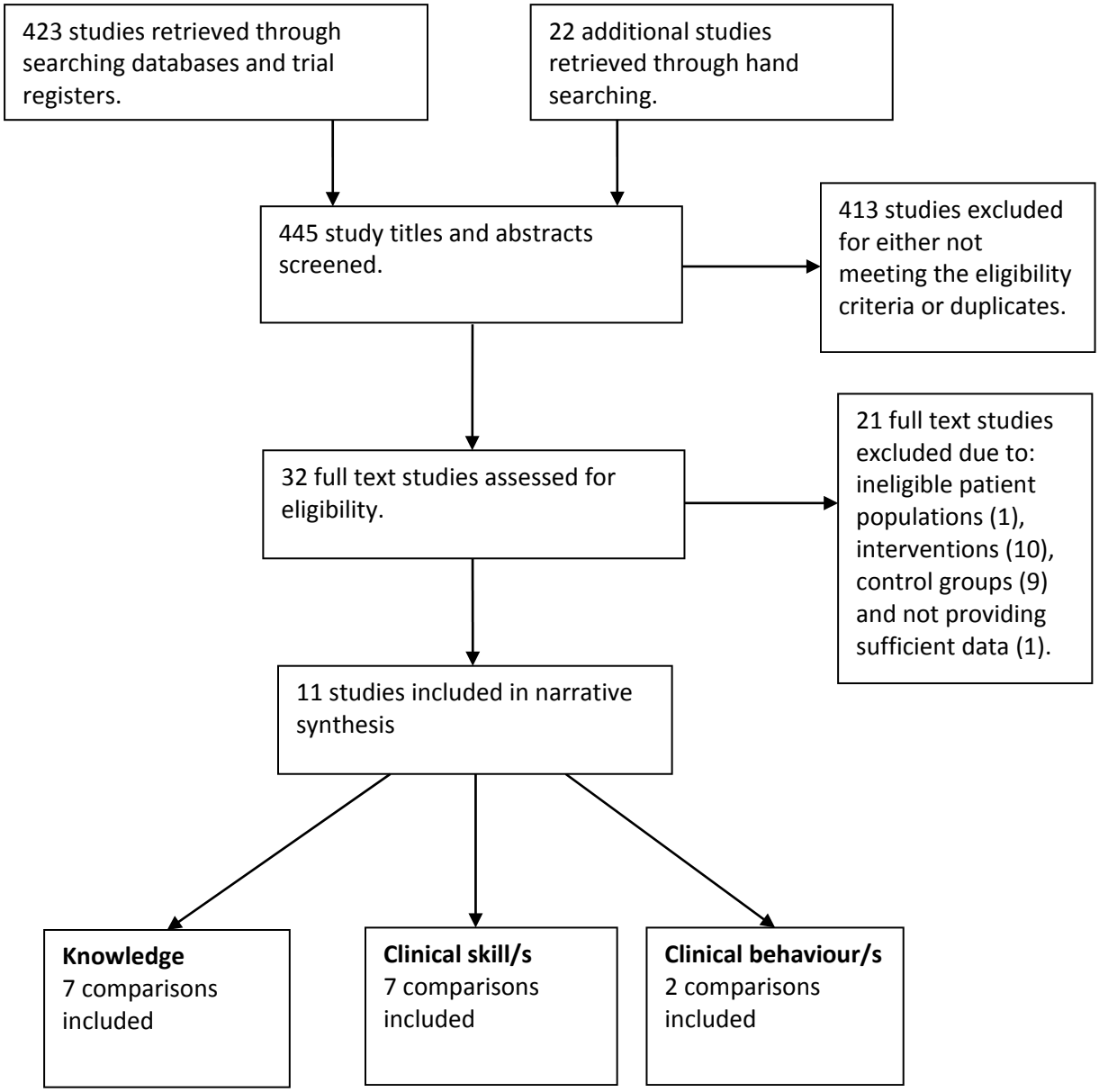
Exploring the effects of different control interventions and of methodological quality could not be undertaken, due to poor reporting and previously detailed heterogeneity.

2.4 Results

2.4.1 Study selection

A total of 11 randomised controlled trials were identified for inclusion in this review. Figure 1 illustrates the flow of studies through the different stages of this systematic review.

Figure 1. Flow diagram of studies through the different phases of the systematic review.



As evident from Figure 1, a total of 423 studies were retrieved from searching the electronic databases: Medline (240), Cinahl (98), Amed (11), EMBASE (43) and The Cochrane Library (31). Searching the reference lists of relevant studies identified a further

22 studies. Two independent reviewers (Helen Richmond and Chris Bridle) assessed the titles and abstracts, leading to the exclusion of 413 studies. The full text of the remaining 32 studies were assessed for eligibility by the same two reviewers independently, where a further 21 studies were excluded since they did not meet the eligibility criteria (reasons for exclusion are detailed in appendix 3). The remaining 11 studies were eligible and thus included in this review.

2.4.2 Study Characteristics

Methods

Ten of the eleven included studies were individually randomised controlled trials (RCTs); the other study was a cluster randomised trial (66). All studies were published in English between January 2000-October 2011. Seven of the studies were single centre, two were multi-centre (66, 67), and the remaining two centres did not report the number of centres (52, 68). Five studies were conducted in a hospital setting, three in primary care and three in a University setting.

Participants

From the 10 individual RCTs, there were a total of 601 participants. The number of centres in the cluster randomised trial (66) was 36; however, the number of participants within each centre was not reported. The majority of studies were concerned with medical doctors (6 studies), with the remaining 5 studies investigating allied health care professionals (52, 68-71). Whilst 6 of the 11 studies investigated medical professionals, the areas of speciality and level of training varied greatly.

In addition to the different professional areas and specialities, the populations were also variable in relation to age (reported in four studies), gender and health care environment. The studies were conducted across a range of geographical locations, including Italy (72), Canada (73, 74), the United Kingdom (66), the United States of America (52, 67, 68, 75), the

Netherlands (69), Finland (70) and Brazil (71). Participation was voluntary in eight studies and not reported in one (73). Recruitment methods, where reported, were similar across studies, sending invitation letters to potential participants, giving presentations and placing adverts.

Interventions

The 11 studies were highly variable with regards to the clinical area of the interventions, the duration and complexity of the interventions, the number and type of comparison interventions and whether access to teaching faculty was available. The clinical topics of the interventions were wide ranging. Six of the studies were concerned with teaching practical skills (five medically based (70, 72-75) and one in cognitive-behavioural therapy (52)) and four studies were concerned with teaching knowledge (continuing medical education (67, 69); guidelines (66); CBT (68) and human resources (71)). The duration of the interventions varied considerably among studies, ranging from 15 minutes (73) to 36 hours (72). Ten of the interventions were internet based with the other using a CD Rom package (66). The components of the different interventions are summarised in Table 2 below.

Table 2 suggests that some of the interventions were more comprehensive than others. However, the majority of the interventions were poorly reported and therefore, may have utilised more complex components, yet failed to report them. A common finding amongst all study interventions was the lack of, or failure to mention, any theory behind the development or delivery of the interventions.

Table 2. A summary of intervention components

Study	Components of intervention	Learning/psychological theories
Bello (2005)	Didactic slides, video multimedia and a threaded discussion forum with access to tutors.	None stated
Chenkin (2008)	Video, self-assessment quizzes, animations and a non-linear navigation system. Practical: 2 hours independent skills practice	None stated
Paladino (2007)	PowerPoint presentations	None stated
Hugenholtz (2008)	Didactic text, cases to solve and MCQ	None stated
Beyea (2008)	Presentation slides, diagrams and short exercises.	None stated
Fordis (2005)	Didactic text, interactive cases with feedback, interactive clinical problem solving tools, email contact with teaching staff and a one off web conference.	None stated
Makinen (2006)	Video and picture multimedia and questions between content pages.	None stated
Downs (2006)	Themed e-book (no further information provided).	None stated
Sholomskas (2005)	Didactic text, FAQ's, MCQ's with feedback and 12 virtual role plays with clinical vignettes.	None stated
Xiao (2007)	Didactic text, still images and short video clips.	None stated
Weingardt (2006)	Video vignettes and flash animation.	None stated

Controls

In seven of the included studies, multiple control groups were used. In four of these studies (66, 68, 70, 75), not all control groups were included since they were not eligible. In five studies, the duration of the control matched that of the intervention (52, 68, 69, 73, 74) .

Classroom control

The control group in Bello et al (72) was delivered in a classroom setting using presentation slides, live demonstration of techniques with dummies and video multimedia. The classroom teaching lasted 5 hours, whereas the online course was available for 36 hours.

Chenkin et al (74) used a didactic lecture in a classroom setting and provided participants with a handbook. The duration of the control (one hour) equalled that of the intervention. Following the intervention, both groups practiced their skills for two hours (without instructors). It was not reported whether both groups practised together or if the practice session was separate. Padalino et al (71) provided no further information pertaining to the control intervention other than it consisted of two hours of live classroom teaching.

Lecture control

Hugenholtz et al (69) randomised participants into two (identical) online-learning groups and two (identical) live lecture groups, essentially making one comparison despite having four groups. No additional information is provided regarding the live lecture groups. The duration for both interventions was the same, lasting 30 minutes. Weingardt et al (68) also used a live lecture consisting of a 60-minute didactic presentation containing identical content to the web-based module.

Small interactive teaching/workshop control

Fordis et al (67) used a small group interactive workshop for the control group. The workshop lasted two hours and consisted of didactic presentations with a question and answer session and case discussions. Access to faculty members was available through email and telephone. Makinen et al (70) also compared the intervention to small group instruction. A third group, receiving no intervention, was excluded. The small group instruction consisted of a 30 minute theoretical session followed by a 3.5 hour practical session.

Downs et al (66) used three comparison groups (practice based workshops; decision support software and 'no intervention' control). The latter two groups were excluded since they did not receive any form of educational training. The practice based workshops were

run by two General Practitioners with discussion and reflection on real patient cases. They provide no indication of how long the interventions lasted for.

Paper based control

Xiao et al (75) used a paper based control group and a 'no intervention' control group. The latter group was excluded since these participants received no active intervention. The paper based training consisted of a paper hand-out with still images. The duration of the paper based training was not reported.

Studies where multiple control groups were included

Beyea etal (73) used two control groups: small group instruction (SG), led by an experienced physiotherapist, and standard classroom instruction (SC), delivered by a senior resident. Participants in the SG group were able to practice skills with their peers and were given feedback from the physiotherapist. Both control groups, and the intervention, lasted 15 minutes. Sholomskas et al (52) also used two control groups: a manual only group, and a group receiving the manual plus three days of didactic seminars with supervision of cases. Participants in the latter group received 3-days of lectures including videotaped CBT sessions, active role plays and up to three one hour supervision sessions. Those in the manual only group received the paper manual and were advised to study it for a period of 20 hours.

Outcomes

The primary outcome in five of the studies was knowledge gain (67-69, 71, 72); in five studies it was an assessment of practical skills (52, 70, 73-75) and in the remaining study, it was a measure of clinical behaviour (guideline concordance; (66)). Secondary outcome measures included practical skills (if knowledge was the primary outcome), satisfaction, time and adherence. The majority of studies assessed outcome measures only once following the intervention, with two studies conducting outcome measures at two time

points (52, 67). None of the included studies measured level four outcomes (patient outcome measures) according to Kirkpatrick's evaluation model (62).

Practical skills

Three studies investigated the effect of the interventions on practical skills only. Beyea et al (73) measured practical skills at baseline and seven days post intervention. Two practical tests were performed (a live observation of the required skill and performance of the skill using a DizzyFIX machine). There is no description of the validity or reliability of the DizzyFIX machine. Makinen et al (70) used an Objective Structured Clinical Examination (OSCE) to assess participants' practical skills in performing the particle repositioning manoeuvre. The OSCE was performed two weeks post intervention, no baseline data was collected. Similarly, Xiao et al (75) only conducted post intervention outcome measures. Participant's compliance with sterile techniques for central venous catheter insertions was evaluated though video recordings of participants performing the technique, up to four months after the intervention (compliance with sterile techniques).

Knowledge

Three studies solely evaluated knowledge gain. Hugenholtz et al (69) measured knowledge at baseline and immediately post intervention. One 66-item MCQ (developed by relevant experts) was divided into two 33-item MCQs (Knowledge test X and Knowledge test Y). The participants were randomised into one of four groups (two receiving the same intervention and two receiving the same control), two groups taking test X at baseline and Y at follow-up, and the other two groups completing the tests in the opposite order. Thus ensuring the tests were different, though comparable. Padalino et al (71) collected outcome data at baseline and immediately following the intervention on participants' knowledge (questionnaire). The questionnaire was developed by the researcher and the educational team who developed the e-learning programme. Weingardt et al (68) measured knowledge

at baseline and immediately following the intervention. They used the same 17-item questionnaire for both tests, changing the order of the questions for the follow-up to reduce response bias. No information was provided concerning how the questionnaire was developed or by whom.

Knowledge and practical skills

Three of the studies investigated the effect of the interventions on both knowledge gain and practical skills. Bello et al (72) assessed participants' knowledge (multiple choice questionnaire, MCQ) at baseline and 48 hours post intervention. They also assessed practical skills (practical skills test), satisfaction (three questions) and time (instructor and learner) at 48 hours post intervention. There is no report of how the outcome measures were created, or if they were piloted before this study. Chenkin et al (74) collected outcome data at baseline and two weeks post intervention measuring knowledge (written exam), practical skills (Objective Structured Clinical Examination, OSCE) and satisfaction (5-point likerk scale). The OSCE exam was scored by multiple examiners, and whilst the OSCE was piloted before use in the study, the inter- and intra-rater reliability were not measured. Sholomskas et al (52) collected outcome data at baseline, four weeks and four months post intervention. They measured CBT skills (video-taped role plays analysed and scored using the Yale Adherence Competence Scale), CBT knowledge (MCQ) and satisfaction (MCQ).

Fordis et al (67) evaluated knowledge (MCQ) at baseline, immediately and 12 weeks post intervention, and clinical behaviour (screening and treatment, measured through patient chart audits) at five months prior and five months post intervention. The knowledge test was developed and validated by content experts, and was piloted prior to use in the study. Downs et al (66) measured outcomes at baseline and nine months post intervention. The outcome measures were concerned with clinical behaviour (rather than a direct measure of knowledge gain): dementia detection rate (searched for cases), diagnosis concordance

score (10 items) and management concordance score (7 items). The concordance with guideline scores were recorded through subjective analysis of electronic patient records. The desired actions (for concordance) were derived from a critical review and an expert advisory group of evidence based guidelines. The baseline assessments spanned a greater length of time (up to 12 years); than post intervention assessment (9 months).

Reporting of outcomes

In addition to the heterogeneous outcome measures of the studies, the methods for reporting the outcomes were also variable. In five of the studies the results were presented as means and standard deviations (52, 66, 67, 69, 71). Two studies presented dichotomous data (pass/fail (73); compliant/non-compliant (75)). Chenkin et al (74) provided the percentage of correct answers with standard deviations, Makinen et al (70) presented means with no standard deviations, and Bello et al (72) provided median scores.

Table 3 below provides a summary of the narrative detailed above. As evident in Table 3 and from the previous narrative, the studies included in this review had high heterogeneity with regards to the clinical speciality, the training interventions themselves, the comparator groups, the method and timing of outcome assessments and in the reporting of results.

Table 3. A summary of the included study characteristics

Author	Setting (N centres)	Participants (N; type)	N groups	Clinical topic	Study intervention	Comparison Intervention	Intervention / control duration	Outcomes assessed	Follow-up/results
Bello (2005)	Hospital (1)	56; medics	2	Airway management	Online course	Classroom teaching	I: 36 hours C: 5 hours	Knowledge (P); practical skills; satisfaction	48 hours; no statistically significant differences
Beyea (2007)	University (1)	25; medics	3	Particle repositioning manoeuvre	Online module	C1: classroom instruction C2: Small group	I: 15 mins C1 & C2: 15 mins	practical skills	7 days; no statistically significant differences
Chenkin (2008)	University (1)	21; medics	2	Ultrasound guided vascular access	web-based tutorial	didactic lecture	I: 1 hr (+2 hr skills practice) C: 1 hr (+2 hr skills practice)	knowledge; practical skills (P)	2/52; no statistically significant differences
Downs (2006)	GP practice (36)	36 (practices); medics	4	Detection rate & concordance with dementia guidelines	Electronic tutorial (CD)	1 eligible: small group workshop	n/r	Dementia detection rate; diagnosis and management concordance	9/12; control group showed significantly higher detection rates; no statistically significant differences for concordance
Fordis (2005)	Primary care (21)	103; medics	2	CME for cholesterol management	Online course	Didactic lecture and case discussions	I: n/r C: 1.5-2 hours	knowledge (P); clinical behaviour	Post I and 12/52; statistically significant higher prescribing per guidelines in internet group; no other differences

Hugenholtz (2008)	Postgraduate meeting (1)	74; occupational physicians	4	CME for mental health care	2 x E-learning	2 x Didactic lecture	I: 30 mins C: 30 mins	Knowledge	Post I; no statistically significant difference between groups
Makinen (2006)	Geriatric hospital (1)	56; geriatric nurses	3	Cardio pulmonary Resuscitation and defibrillation	web-based course	1 eligible: small group teaching with 3 hour practical	I: 15-30 mins C: 4 hours	Practical skills	Small group teaching had a median score of 34 versus 28 in the internet group (P<0.05).
Paladino (2007)	Private hospital (1)	49; night shift nurses	2	Quality & human resources	e-learning course	on-site course	I: 40 mins C: 2 hours	knowledge	No statistically significant difference between groups
Sholomskas (2005)	Clinics (nr)	78; counsellors	3	CBT for substance abuse	interactive web site + manual	C1: manual only C2: manual + 3 day didactic seminars and supervision	I: 20 hours C: 20 hours (+ 3 further supervision hours)	CBT skills (P); knowledge; adherence; satisfaction	Effect sizes (for knowledge and skills) were greater for the C2 group than the web based group against the C1 group.
Xiao (2007)	University urban trauma centre (1)	32; medics	3	Sterile practice for central venous catheter insertions	Online video based training	1 eligible: paper hand out	I: < 1 hour C: n/r	Practical skills	N cases of full compliance: Paper: 12/31 Online video: 14/19

Weingardt (2006)	University (nr)	107; counsellors	3	CBT for substance abuse	60-minute web-based module	1 eligible: 60-minute face-to-face presentation	I: 1 hour C: 1 hour	Knowledge	Post I; Both groups improved compared to no-intervention control.

P: primary outcome measure C1: control group one C2: control group two

2.4.3 Assessment of Bias

The Cochrane Effective Practice and Organisation of Care (EPOC) 'risk of bias' assessment tool (65), appendix 4) was used to evaluate the quality of the included studies. Summaries of the final risk of bias assessments are presented in Tables 4 and 5 (an example of the assessment of bias that was conducted for each study is presented in appendix 5).

Table 4. Risk of bias items for each included study

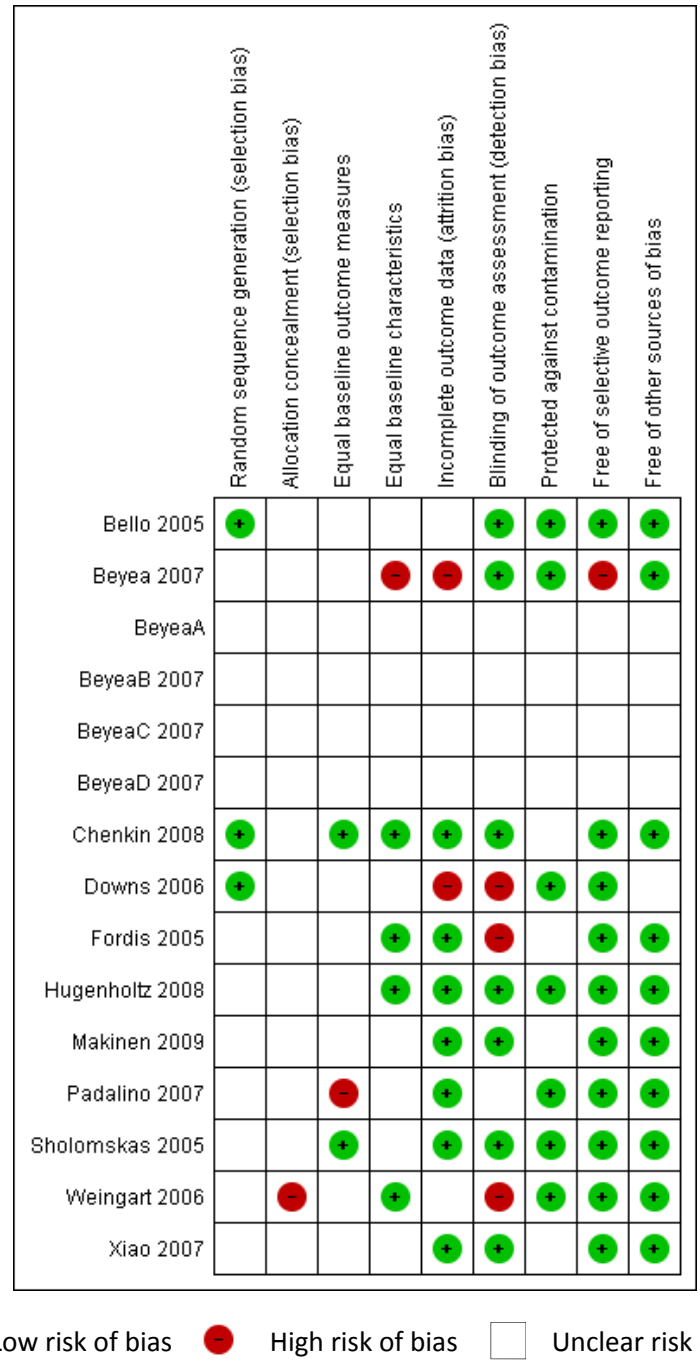
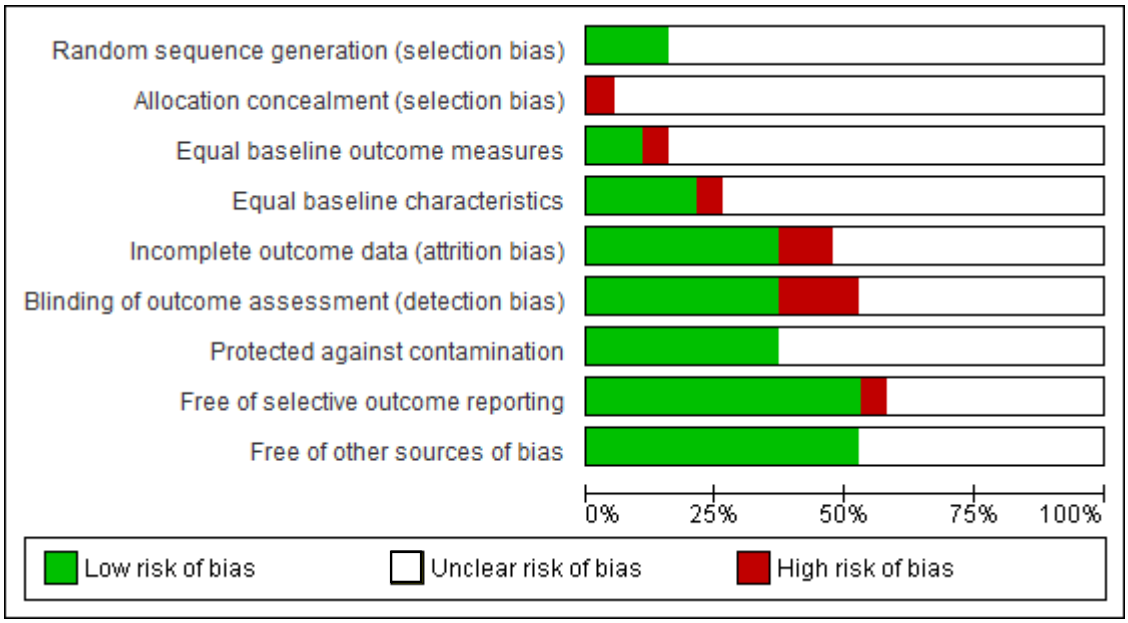


Table 5. Risk of bias items presented as percentages across all included studies



As evident from Tables 4 and 5, the quality of reporting was generally poor, leading to judgements of 'unclear' risk of bias in over 50% of studies in four of the nine items. Only three studies provided adequate information to assess random sequence generation and equal baseline outcome measures, while 10 studies provided sufficient detail to assess allocation concealment. The majority of studies assessing practical skills blinded the observers and thus their primary outcome assessment was blinded. All studies were free from selective outcome reporting except one (73), who asked participants if they felt they performed the manoeuvre correctly, and did not report the results. Nine studies were free from other sources of bias, with the other (66) assessed as 'unclear', since they failed to provide data reporting on whether the CD-ROM was actually used and how or if it was given to practices.

2.5 Narrative summary of results

The studies were narratively synthesised (individual study results in appendix 6), discussing the trial level effect sizes (where available) for each of the main outcome measures: Knowledge gain, practical skills, clinical behaviour and patient outcomes. Since none of the studies reported patient outcome measures, this outcome is not detailed below.

2.5.1 Knowledge gain

Seven studies investigated the effect of an online intervention on knowledge, although effect sizes could only be calculated for five comparisons (from four studies). The standardised mean differences in Table 6 show that the direction of effect size was variable (positive favouring intervention; negative favouring control) and, on the whole, small. All effect sizes were non-significant with the exception of Padalino et al (71).

Table 6. A table of effect sizes of the intervention on knowledge outcomes

Study	Outcome	Control	Standardised mean difference (95% CI)	Weighted mean difference (95% CI)
Chenkin (2008)	Knowledge (MCQ)	Lecture	-0.21 (-1.07, 0.65)	-1.50 (-7.45, 4.45)
Hugenholtz (2008)	Knowledge (MCQ)	Lecture	0.08 (-0.38, 0.54)	0.75 (-3.54, 5.04)
Padalino (2007)	Knowledge (MCQ)	Classroom teaching	0.61 (0.04, 1.18)	1.60 (0.17, 3.03)
Sholomskas (2005)a	Knowledge (MCQ)	Manual only	0.28 (-0.28, 0.84)	1.9 (-1.86, 5.66)
Sholomskas (2005)b	Knowledge (MCQ)	Seminar plus supervision	-0.03 (-0.58, 0.52)	-0.20 (-3.59, 3.19)

2.5.2 Practical skills

Although seven studies measured the effect of the intervention on practical skills, effect sizes could only be calculated for three comparisons, reported in two studies (Table 7). Positive effect sizes favour the intervention with negative effect sizes favouring the control.

Table 7. A table illustrating the effect sizes of the interventions on practical skills

Study	Outcome	Control	Standardised mean difference (95% CI)	Weighted mean difference (95% CI)
Chenkin (2008)	Practical skills (OSCE)	Lecture	-0.37 (-1.24, 0.49)	-2.80 (-8.73, 3.13)
Sholomskas (2005)a	CBT skills (Role play)	Manual only	0.25 (-0.31, 0.81)	0.35 [-0.42, 1.12]
Sholomskas (2005)b	CBT skills (Role play)	Seminar plus supervision	-0.47 (-1.03, 0.09)	-0.69 [-1.48, 0.10]

Sholomskas et al (52) measured outcomes at four weeks and four months. Since the other studies recorded short term outcome measurements only, the four week outcome measures were presented (effect sizes for four month outcomes can be found in appendix 6). As evident from above, Chenkin et al (74) and Sholomskas et al (52) found effect sizes in favour of the active control groups; an effect size in favour of the online intervention was observed against the manual only control group (52). Thus suggesting that results favoured the control intervention when a more complex comparison group was utilised. However, the effect sizes were small and were not statistically significant.

2.5.3 Clinical behaviour

Two studies evaluated the effect of interventions on clinical behaviour, both using two different clinical measures within each study, giving four comparisons for effect sizes (Table 8; positive effect size in favour of the intervention; negative effect size in favour of control).

Table 8. A table showing the effect sizes of the intervention on clinical behaviour

Study	Outcome	Control	Standardised mean difference (95% CI)	Weighted mean difference (95% CI)
Fordis (2005)a	Clinical behaviour (Treatment)	Small group teaching	0.51 (-0.16, 1.18)	4.40 (-0.97, 9.77)
Fordis (2005)b	Clinical behaviour (Screening)	Small group teaching	0.34 (-0.31, 1.00)	2.30 (-1.88, 6.48)
Downs (2006)c	Diagnosis concordance	Practice based workshop	0.05 (-0.88, 0.98)	0.10 (-1.68, 1.88)
Downs (2006)d	Management concordance	Practice based workshop	-0.52 (-1.47, 0.43)	-0.80 (-2.14, 0.54)

As illustrated in Table 8, the effect sizes were consistently in favour of the intervention group in three of the comparisons and in favour of the control group in the other (Downs 2006d). The sizes of the effects were variable and none of them were statistically significant.

2.5.4 Additional analyses

Pre-planned analyses were described to investigate the effect of specific components thought to improve the effectiveness of online learning. Table 9 summarises which interventions, if any, utilised any of these identified components.

Table 9. A table showing which individual components were used in the different interventions

Study	Intervention characteristics/components							Total (of 7)
	Internet platform	Repetition	Interactivity	Online discussion	Audio	Feedback	Practice exercises	
Bello (2005)	Internet	NR	NR	Yes (threaded forum)	NR	NR	NR	**2**
Beyea (2007)	Internet	NR	Yes (one short exercise)	NR	NR	NR	NR	**2**
Chenkin (2008)	Internet	NR	Yes (self-assessment quizzes, non-linear navigation system)	NR	NR	NR	Yes (self assessment quizzes)	**3**
Downs (2006)	CD Rom	NR	NR	NR	NR	NR	NR	**0**
Fordis (2005)	Internet	NR	NR	Yes (access to experts via email/web conferencing)	NR	Yes (cases with scripted feedback)	NR	**3**
Hugenholtz (2008)	Internet	NR	Yes (case studies to solve)	NR	NR	NR	Yes (MCQ)	**3**
Makinen (2006)	Internet	NR	Yes (Q's between content pages)	NR	NR	Yes (answers to Q's)	Yes (questions between pages)	**4**
Padalino (2007)	Hospital intranet	NR	NR	NR	NR	NR	NR	**1**
Sholomskas (2005)	Internet	NR	Yes (5 diff activities inc virtual roleplays)	NR	NR	Yes (to MCQ and role plays)	Yes (MCQ)	**4**
Xiao (2007)	Internet	NR	NR	NR	NR	NR	Yes (quizzes)	**2**
Weingardt (2007)	Internet and CD-ROM versions	NR	Not specifically reported - authors use video vignettes	NR	NR	NR	NR	**2**
Total	**10**	**0**	**6**	**2**	**0**	**3**	**5**	

KEY: Q: question MCQ: multiple choice questions

As evident from the Table 9, based on the descriptions provided in the papers, none of the studies used audio or repetition; just over half of the studies used interactivity and practice exercises, and only a few used online discussion and feedback. Since effect sizes for outcomes could not be calculated for a number of the studies, along with the small number of studies using the different components, further analyses investigating the consequence of these components on effect sizes were not conducted. As detailed earlier, since it was not appropriate to perform meta-analyses, sensitivity analyses investigating the influence of methodological quality on treatment effect size were also not conducted.

2.6 Discussion

2.6.1 Summary of findings

The evidence base (RCTs) for estimating the effectiveness of online learning in this population is limited. Whilst eleven RCTs and one cluster RCT were included in this review, many of the sample sizes were small. All included studies were of poor methodological quality. For the majority of studies, the interventions and study results were poorly reported, with data to calculate effect sizes available in only six studies. Due to methodological, statistical and clinical heterogeneity of the included studies, it was not appropriate to pool these effect sizes in meta-analyses. The effect sizes showed no statistically significant differences between online learning interventions and more traditional, face to face or paper-based interventions on health care professionals' knowledge, practical skills or clinical behaviour. There were no clear directions of effect for any of the outcome measures. Whilst this could be a result of the previously mentioned limitations of the included studies, such as a lack of power, it could also be interpreted to mean there were no actual differences in effectiveness between online learning and traditional methods (such as face-to-face). This may suggest that online learning is a viable alternative to traditional methods of training.

It was also not possible to isolate the effect of specific intervention components on any of the outcome measures. Thus, this review was not able to provide any information about which components of online interventions may result in greater satisfaction and effectiveness of learning for health care professionals. None of the studies used validated outcome measures or any framework for evaluation of the online learning programmes. Additionally, since none of the studies addressed level four outcome measures (all were concerned with levels 1-3: health care professionals' reactions; their learning; and any transfer of knowledge), the review cannot provide any information as to whether online

training can produce equal or superior results for patients compared to training in traditional formats.

2.6.2 Issues concerning the variations in observed effect sizes

Firstly, many of the included studies were small with half of the RCTs including less than 50 participants and only two studies recruiting more than 100 (67, 68). Six of the ten RCTs used more than two comparison groups and therefore needed a greater number of participants to detect any intervention effects. In addition to the small sample sizes, the wide confidence intervals around the effect sizes are an indication that the studies were under powered (76). Secondly, the differences in study control groups may have contributed to the varying direction of effect sizes. In two comparisons (52, 75), the intervention was compared solely to a paper-based control. Effect sizes could only be calculated for the first study, though study results from both papers suggested effects in favour of the intervention groups. On the other hand, there were four comparisons of the intervention to interactive, small group teaching (52, 66, 70, 73) where all effect sizes favoured the control groups. However, none of these effect sizes were statistically significant and therefore no conclusions can be drawn between the effect sizes and the different control groups.

Thirdly, the fidelity of the interventions themselves should be considered. One of the cited advantages of online learning is the flexibility of learning, enabling users to learn in an environment and time suitable to them (49). However, few studies actually reported participant log-in times, and even amongst those that did, these times do not necessarily reflect active learning. Contrastingly, in a small interactive group, the researchers were able to ascertain the time the participants were engaged in active learning. Thus, without recording the adherence of participants in the intervention groups, it is not possible to ascertain whether the learning was carried out as intended, which in turn may have resulted in effect sizes favouring the control group. Another factor to consider is the

varying lengths of the interventions and their controls. The length of the intervention and control were only reported in 7 of the 11 studies and in 50% of these, the duration of the intervention differed greatly from the duration of the control. Thus producing another potential confounding variable when trying to determine the effectiveness of online learning.

Additionally, the components/content of the interventions, which were poorly reported in the majority of studies, should be considered. Indirect effects such as costs, how the online learning programme was developed and who developed it could impact upon the effectiveness of the intervention (77, 78). For example, a specialist company may produce a programme of greater technical quality than a local health care professional involved in research. As previously mentioned, specific design features, such as interactivity, are associated with improved learner engagement and satisfaction (53). Thus, engaging online programmes may have exerted greater effects than simple programmes. Unfortunately, poor reporting of both the study interventions and results meant that the effects of these components could not be isolated; thus, any relationship between particular design features and effect sizes could not be explored. This poor reporting also precludes future use of the interventions in clinical practice or in future research, since the authors do not provide enough information to reproduce the interventions (79).

Lastly, several of the outcome comparisons contained studies with multiple control groups. Therefore, multiple comparisons against the same intervention, with different control groups, were included. Since the effect sizes were not pooled in meta-analyses this is not of great concern, however, the inclusion of multiple comparisons from a single study for the same outcome mean that any biases of that study will have occurred twice within that outcome (60).

2.6.3 Current findings in relation to BeST

BeST is a complex intervention and as such, the process of training health care professionals to effectively deliver it as intended, is also complex. Two studies in this review investigated the use of online learning to train clinicians in a CBT-based intervention (52, 68). One of which was a brief module that aimed to raise knowledge on a topic with a narrow scope (68), while the other trained clinicians in a fully manaualised treatment intervention (52). The authors of this latter study raised the issue of a lack of evidence evaluating online learning for delivering training in manual guided psychotherapies. This is supported by this review, where the majority of studies investigated competency of a single practical skill or gains in factual knowledge. Whilst this review identified one study of a similar complexity to the BeST intervention (52), the study itself had many methodology flaws. For example, the development of the intervention was not described, and their randomisation process failed, with over half of the participants allocated by choice (52). Thus, the study does provide some basis for investigating the effectiveness of online learning in training health care professionals to deliver a structured CBT intervention; however, it does not provide conclusive or substantive evidence to draw on.

2.6.4 Current findings in relation to the literature

Despite the stricter and more precise inclusion criteria of the current review, the findings are in agreement with those of Cook et al (49), who conducted a broad systematic review on the effectiveness of online training and found a lack of effect size in either direction when online training was compared to alternative forms of training. Since the effect of specific intervention components could not be isolated in this review, the findings cannot be compared to the later review by Cook et al (53), which investigated design variations of Internet based learning.

2.7 Limitations

2.7.1 Outcome level

As previously discussed, included studies were at either high or unclear risk of bias. Descriptions of interventions and study methods were poorly reported in all studies. No studies investigated patient level outcomes measures, which is ultimately the reason for training health care professionals. Effect sizes could only be calculated for 6 of the 11 studies and were imprecise with wide confidence intervals, limiting the conclusions that can be drawn.

2.7.2 Study and review level

- Whilst every effort was made to obtain all relevant RCTs, it is possible that some studies may not have been identified if they were indexed in unknown databases or difficult to locate.
- A source of potential bias may have arisen from the study selection, data extraction and assessment of bias processes. However, the data extraction forms were piloted and a second reviewer performed the study selection, data extraction and assessment of bias of the studies, reducing the chance of researcher bias and error influencing these processes.

2.8 Conclusions

All studies investigated the effectiveness of online interventions in comparison to traditional training methods and found no significant differences. This suggests that online learning may be an effective method to train health care professionals at lower costs and with greater ease of dissemination. Since none of the studies measured level four (patient) outcomes, it is not possible to ascertain the effectiveness of training health care professionals via online methods on patient outcome measures.

2.8.1 Implications for the aims of this thesis

Only one study evaluated a complex and structured intervention comparable to BeST, and this study favoured face-face traditional training. Additionally, none of the included studies aimed to train professionals in a new treatment approach considered outside the participants immediate scope of practice. Thus, when considering the use of online training for the implementation of BeST, there is need to evaluate the efficacy of this method for training health care professionals to deliver a complex intervention based within a new paradigm to the learners. Lastly, due to the poor reporting of online learning interventions in this review, there is a need to further explore how online learning can be designed to achieve optimal performance. This thesis will now detail the process of developing the online training programme (i-BeST) before moving on to consider its evaluation.

Chapter 3 - Development of the BeST online training course

3.1 Preface

In chapter two, the systematic review highlighted the need to determine whether a complex intervention, such as BeST, can be successfully taught to health care professionals using an online delivery medium. Before detailing the process of developing the online course, some background information regarding the BeST intervention training in the original trial needs to be provided. During the BeST trial (14), participating health care professionals attended a 1.5 day face-to-face workshop to both train them in the BeST intervention and brief them on trial procedures. The workshop consisted of oral presentations, video demonstrations, role-play exercises for the practice of new clinical skills, discussion around various topics and feedback from both peers and the trainer. The aims of the BeST training workshop were to provide the health care professionals with:

- An understanding of the rationale for the original research trial (39).
- An understanding of the cognitive behavioural (CB) model.
- The skills to deliver a CB group intervention.
- An understanding of the aims and content of the assessment and each group session.
- The details of what record keeping / claim forms were required for the trial (the BeST trial).

The workshop was supplemented with a detailed therapist training manual that contained sufficient evidence so that the intervention could be replicated. In addition to the manual, therapists were provided with crib sheets for each session to help prompt them during the session delivery, and were given access to a website where they could download the required paperwork for the sessions and the trial. The therapists also had access to a forum that was moderated by the trainer, providing an opportunity to ask questions or

voice any concerns. Following the training, informal clinical mentoring was provided by the specialist cognitive-behavioural physiotherapist who was a member of the BeST development team.

The face-to-face training was documented in a folder containing the training schedule, Power-Point presentations and participant feedback from the training. This documentation provided an essential record of the training. However, the content on the Power Point presentation slides was brief, since the majority of the content was delivered verbally around the presentation slides. Thus, most of the training content was not recorded or detailed anywhere, giving rise to the first obstacle in producing content for the online training resource. This chapter describes the complex and challenging journey of producing and refining an online training programme, named 'i-BeST', from the previously detailed face-to-face training.

3.2 Introduction

In the last decade there has been growing interest in the use of online learning within the NHS for training health care professionals in various procedures and clinical skills (80, 81). In particular, the NHS's e-learning for Health, providing training to Health Care Professionals, has rapidly expanded following the success of its initial radiology module and now offers 65 online programmes in various clinical related topics. The use of the Internet for delivering treatments to patients has also been increasing. For example, 'Beating the Blues', a computerised cognitive behavioural therapy treatment for patients with mild to moderate depression, has been well received by patients and is now recommended by NICE (82). Despite prolific growth in the use of online learning, there is little research to guide clinicians or educators in the methods of producing such resources. This process of transforming paper based materials into online formats is frequently cited in the literature as both complicated and multifaceted (78, 83). Numerous authors state that the

production of a well-designed online course requires a substantial amount of preparatory work, a large multi-disciplinary team and an, often large, initial economic investment (83, 84).

There is a lack of guidance regarding the development processes that are involved in the production of online resources. Previously, authors have advocated the use of cognitive learning styles as a basis to develop and tailor programmes (85, 86). However, Mayes and Freitas (87) point out that, despite intensive efforts, there is a lack of research to support their existence. They also highlight that the idea of a 'learning style' is in direct contrast to the notion that all learning is context dependent, where individuals will learn differently in different contexts (87). More recently, Cook (88) systematically reviewed the literature and concluded that learning styles were not integral to the success of online programmes, suggesting instead that instructional design features were more significant (88). Since the systematic review in this thesis was unable to isolate the impact of different design features on intervention effectiveness, the review by Cook et al (53), detailed in chapter two, provides the only substantive basis within the healthcare education literature on how learning outcomes might be enhanced by particular design features. Another source of guidance could be derived from the growing number of individually published papers concerning the evaluation of online training for health professionals (as identified by the systematic review, chapter 2). However, the processes involved in the development of the online interventions were poorly reported or absent in these papers which frequently offered only a brief description of the development process.

Recognising this lack of support for educators trying to develop online resources, Cook et al (83) published a 10-step practical guide for the design of effective web-based learning. The document forms a useful guide to aid the design of online programmes, however, much of the content is subjectively devised from the authors own personal experiences. Looking

outside the field of health care, research in online learning is vast. Whilst reviewing all the literature in this field in detail may provide further guidance, it is both outside the scope of this project and, in many cases, not applicable to the current task. Much of the Higher Education literature is concerned with developing online curriculum resources that are compulsory for students and many describe processes involving large teams and resources; neither of which apply in the development of the i-BeST training course (for example, Puzziferro and Shelton (84)).

However, the Joint Information Systems Committee (JISC), set up by Higher Education funding bodies in United Kingdom (UK) to fund information technology investment in UK universities, offers some useful reviews of the literature in this field. In 2009 JISC updated their guide to effective practice in a digital age (89). The guide suggests that the design of an online learning course is likely to occur in one of three broad learning perspectives (associative, constructive (individual and social) and situative). Each of these learning perspectives has fundamentally different views on how learning occurs and therefore has its own pedagogy and assumptions. Briefly, associative theorists believe that competence in advanced knowledge and skills is developed sequentially with small increments of increasing difficulty; thus, learning should begin with simple units of knowledge before progressing onto more complex elements (89). The constructivist perspective, most commonly adopted in Higher Education, states that learners actively construct knowledge through gaining understanding and that new knowledge can only be built upon current understanding. Lastly, the situative theory stipulates that all learning is situated, implying that learning takes place in a social context, is distributed socially, and must be personally meaningful to the individual. Whist one of these theoretical perspectives may inform the basis for the majority of an online learning project, JISC's guide suggests that the majority of online learning will use elements from all three approaches (89). Table 10 shows the

associated pedagogies (89) linked with the relevant instructional design characteristics (87) for all three perspectives.

Table 10. Theoretical perspectives of learning: associated pedagogy and relevant instructional design characteristics

Perspective	Associated Pedagogy	Instructional Design Principles
Associative	• Focus on competencies • Organised activity (routines) • Increasing difficultly • Clearly stated goals • Provision of feedback • Individualised pathways matched to learner's prior performance	• Analyse domain into a hierarchy of small units • Sequence the units ensuring that a combination of units is not taught until its component units are understood individually • Design an instructional approach for each unit in the sequence
Constructivist (individual)	• Active construction and integration of concepts • Activities that foster experimentation • Activities that encourage collaboration • Support for reflection, evaluation and peer review	• Ownership of the task • Coaching and modelling of thinking skills • Guided discovery • Opportunities for reflection • Instructional scaffolding (tailored support) • Ill structured problem solving
Situative	• Environments allowing participation in social practices of enquiry and learning • Supporting development as capable learners • Enables development of learning relationships	• Networked learning • Knowledge sharing • Fostering discussion • Supporting reflection

Although more theoretical than practical, the two JISC guides (87, 89) provide a clear overview to help developers design e-learning courses with sound theoretical underpinning. Therefore, these guides were used to identify the relevant perspective/s for i-BeST and from there to help identify the appropriate learning strategies (stage one, below). Following on from stage one, the practical guide developed by Cook and Dupras (83) was used in conjunction with a learning design model proposed by JISC (87) to guide

the development of the online course content. The learning design model (86) provides steps to follow when constructing online materials detailed as:

- Step one: define learning objectives.
- Step two: develop narrative description of learning and teaching scenario.
- Step three: create learning activity workflow from narrative description.
- Step four: assign resources, tools and people to activities.
- Step five: running (real time).
- Step six: learner support and on the fly adaption.
- Step seven: reflecting.

Together, these two guides facilitated the translation of face-to-face materials into online content and guided how the course was structured and delivered (stage two, below). During the whole process of developing i-BeST, input was sought at various time points from the content experts (Professor Sallie Lamb; Dr Zara Hansen), a technical expert (Andrew Williamson) and a medical educationalist (Dr David Davies), as advocated by Alur et al (90), for the successful production of online teaching sites.

3.3 Methods

3.3.1 Stage One

Considering the BeST intervention in its entirety and the learning outcomes from the original face-to-face training, a set of learning aims for i-BeST were compiled as follows:

- To have an understanding of the cognitive behavioural (CB) model.
- To have the skills to deliver a CB group intervention.
- To understand the aims and content of the BeST assessment and group sessions.

For each aim, a set of learning objectives were devised, illustrated in Table 11.

Table 11. i-BeST course aims and learning objectives

Aim	Learning Objectives
To have a basic understanding of the cognitive behavioural (CB) model.	• To have a basic understanding of the development of cognitive-behavioural therapy. • To distinguish between a CB approach and CBT. • To have a good understanding of the CB model, including its assumptions, theory, levels of cognition and use of problem specific formulations. • To understand the implications of the CB model on thoughts, feeling and behaviours. • To understand the CB model of LBP and how it forms the basis of the BeST intervention. • To understand the 'try it and see' philosophy of the BeST intervention. • To understand their scope of practice and their professional boundary.
To have the basic skills to deliver a CB group intervention.	• To be proficient in using an exploratory style of questioning when delivering the BeST intervention. • To be able to elicit and use feedback and summaries. • To understand the concept of guided discovery. • To facilitate a group managing difficult group members, using active listening and maintaining a discursive style. • Express empathy including dealing with distress. • Effectively teach patients all the self-management skills detailed in the group sessions 1-6.
To understand and effectively perform the BeST assessment.	• To be able to collaboratively set realistic goals and baselines with patients. • To understand the steps involved in the patient assessment and how they differ from traditional physiotherapy assessments. • To be able to perform a patient assessment using the assessment guidelines and form.

To effectively deliver session 1 to patients covering: understanding pain, the complexities of chronic pain, and the effects of inactivity.	• To understand the content of session one including: o Knowledge of the body's neurophysiology. o Knowledge and implications of chronic pain and the physiological and psychological factors thought to influence it. o Knowledge and implications of inactivity. • To be able to deliver session one to a group of patients following the session narrative and using the crib sheet if needed.
To effectively deliver session 2 to patients covering: the impact of activity levels on pain; the skills of pacing, goal and baseline setting.	• To understand the content of session two including: o The concept of negative activity cycling. o To be able to explain negative activity cycling to patients. o To understand and teach the concept of pacing and graded activity. • To be able to deliver session two to a group of patients following the session narrative and using the crib sheet if needed.
To effectively deliver session 3 to patients covering: the identification of thoughts and their distinction from feelings, and the provision of skills to challenge thoughts.	• To understand the content of session three including: o How our thoughts affect our feelings which affect our behaviours. o Negative automatic thoughts (NATS). o Learning how to identify NATS. o Thought challenging techniques. • To be able to deliver session three to a group of patients following the session narrative and using the crib sheet if needed.
To effectively deliver session 4 to patients covering: education on fear of movement and its associated vicious cycle,	• To understand the content of session four including: o Fear avoidance. o The vicious cycle associated with fear avoidance. o Relaxation techniques.

and the teaching of relaxation skills.	• To be able to deliver session four to a group of patients following the session narrative and using the crib sheet if needed.
To effectively deliver session 5 to patients covering: education on the effects of worrying about pain, and further relaxation techniques.	• To understand the content of session five including: o Hypervigilance. o The vicious cycle of behaviour associated with hypervigilance. o Further relaxation techniques. • To be able to deliver session five to a group of patients following the session narrative and using crib sheet if needed.
To effectively deliver session 6 to patients covering: planning how to cope during a pain flare up, and revisiting any areas selected by patient/s.	• To understand the content of session six including: o Flare ups and coping strategies for managing them.

The learning objectives were compared to the assumptions and associated pedagogies of the three main approaches detailed above. A number of these objectives, namely those concerning the learning of factual material, followed that of an associative approach. The remaining outcomes fell under the constructivist perspective, requiring learners to actively integrate new concepts and skills (through practice) into their existing conceptual knowledge. None of the learning outcomes were found to fit with the situative approach. Based on this assessment of the learning objectives, the online training course included the following learning strategies to ensure the activities matched the relevant theoretical perspectives:

- The content was organised and grouped into small modules.
- These modules progressed with increasing difficulty.

- Complex skills, for example, the delivery (content and structure) of a group session, were not presented until the underlying smaller parts had been taught.
- Where applicable:
    - Content encouraged experimentation and discovery of principles.
    - Learners were presented with opportunities to take ownership of learning tasks.
    - Guided discovery was used.

Having identified the perspectives applicable to the i-BeST course and selected relevant learning strategies, the second stage of course development commenced.

3.3.2 Stage Two

Preparatory steps 1-4; Cook and Dupras (83):

1. *Perform a needs analysis; specify goals and objectives.*
2. *Determine your technical resources and needs.*
3. *Evaluate commercial software and use it if it fully meets your needs.*
4. *Secure commitment from all participants; identify and address potential barriers to implementation.*

As evident from the steps detailed above; Cook and Dupras (83) stipulate a needs analysis as the first step in creating an online course. Here, the current problem is identified and the notion of an online course as a solution is evaluated. As previously discussed in chapter 1, the current problem is the large evidence to practise gap that is frequently observed in many clinical practices, including low back pain (7). A major barrier to the implementation of evidence into practice is the provision of essential training for health care professionals, exacerbated in this case by the increasing demand for CB approaches and the lack of qualified trainers available (27, 48). Therefore, if acceptable and effective, the online training programme would provide an essential opportunity for large-scale training of

health care professionals in an evidence-based intervention for LBP (BeST). The training programme would not only enable the therapists to gain specific training in the BeST intervention, it would also train the therapists in many transferrable skills that would apply more broadly to their clinical practice. Examples of this include: a move from a biomedical to a biopsychosocial model of healthcare; improvement of generic skills such as the use of improved questioning techniques, accurate setting of patient baselines, and progressing their goals with effective pacing strategies. For the purposes of this exploratory evaluation the online course needed to serve between 15-20 individuals, however, if rolled out on a national scale its potential is much larger.

Step two recommends considering the technical resources available for the project. Firstly, the resources available to the learners were identified. All users were from the NHS and therefore, if completing the course at work, would be using a PC with Internet Explorer seven or later (91). Secondly, the multimedia tools available to the researcher (Helen Richmond) were established and included: digital cameras, scanners, video recorders, audio recorders, video editing software (basic), audio editing software, and limited drawing software (QuarkXPress; Quark, version 10). No software was available for photo editing. Lastly, the online management software was considered. However, at this stage, the required functionality and features of the online course were not known, making it difficult to establish which software package would be most applicable. Therefore, the various software options were reviewed at a later time (following step 6).

Step four, the last of the preparatory steps, advises that commitment is secured from participants. This aspect of the course was covered in the recruitment of participants into the clinical trial (chapter 5) and is therefore not discussed here.

Development steps 5-8; Cook and Dupras, (83):

5. *Develop content in close coordination with website design.*
6. *Encourage active learning – self-assessment, reflection, self-directed learning, problem-based learning, learner interaction, and feedback.*
7. *Facilitate and plan to encourage use by the learner.*
8. *Plan for formative and summative evaluation.*

In stage 5, Cook and Durpas (83) advise that the online content be developed synchronously with the website design, and warn that existing content should form no more than a basis on which to build and enhance the course content. At stages 6 and 7, the guide encourages the use of active learning, such as problem-based learning, reflection, interaction and feedback, and suggests the incorporation of these features to be the most challenging facet of designing online materials. The importance of these design factors is reiterated in their later review (53), which suggested incorporating interactivity, practice exercises, audio tutorials, feedback and repetition in the course design. The guide also suggests multimedia, hyperlinks and online communication are used to maximise the advantages of learning on the web (83). The processes of developing the online content for i-BeST and the incorporation of various design features are detailed below.

Developing the content for i-BeST

The documentation from the BeST training was used to produce a storyboard to provide an initial guide for the development of the online training resource. Firstly, content was organised into the following categories and placed on index cards: background information, session specific information (1-6), assessment specific information, and therapeutic skills or techniques. This information was then further broken down, for example, background information was split into trial related information, CB information and content that was relevant to LBP itself. Index cards were also created for instructional features, such as, the

log in page. From here, information on the index cards was highlighted to distinguish between the following: didactic information, clinical skills, activities, multimedia images/videos, and downloadable materials. The indexed information was then mapped to visualise how the online course would look conceptually from high-level components (for example, course log in) to low-level components (for example, actual course content). This not only provided a means of picturing the course, it also highlighted that the majority of the training content needed greater depth. With collaboration from the developers of the BeST intervention (Professor Sallie Lamb and cognitive-behavioural physiotherapist, Zara Hansen), skilled colleagues in the field of LBP and chronic pain (Dr Esther Williamson and Dr Mark Williams) and with the use of relevant literature, the content was expanded to the required depth.

i-BeST course structure

Sections of information were arranged in a way that flowed logically with the notion that simpler component parts were to be presented first, progressing in difficulty. For this reason, the course was broken down into the following sections:

- **Introduction**

  Providing the background to LBP, the current evidence base, a CB approach, the BeST intervention, and the CB model of LBP.

- **Session One**

  Providing the content of session one and the knowledge required to deliver the session, as outlined in table 3.2.

- **Session Two**

  Providing the content of session two and the knowledge required to deliver the session, as outlined in table 3.2.

- **Session Three**

  Providing the content of session three and the knowledge required to deliver the session, as outlined in table 3.2.

- **Session Four**

  Providing the content of session four and the knowledge required to deliver the session, as outlined in table 3.2.

- **Session Five**

  Providing the content of session five and the knowledge required to deliver the session, as outlined in table 3.2.

- **Session Six**

  Providing the content of session six and the knowledge required to deliver the session, as outlined in table 3.2.

- **Delivering the intervention**

  Containing descriptions and examples of the clinical skills required to deliver the BeST intervention, such as the style of treatment delivery and the use of exploring questioning.

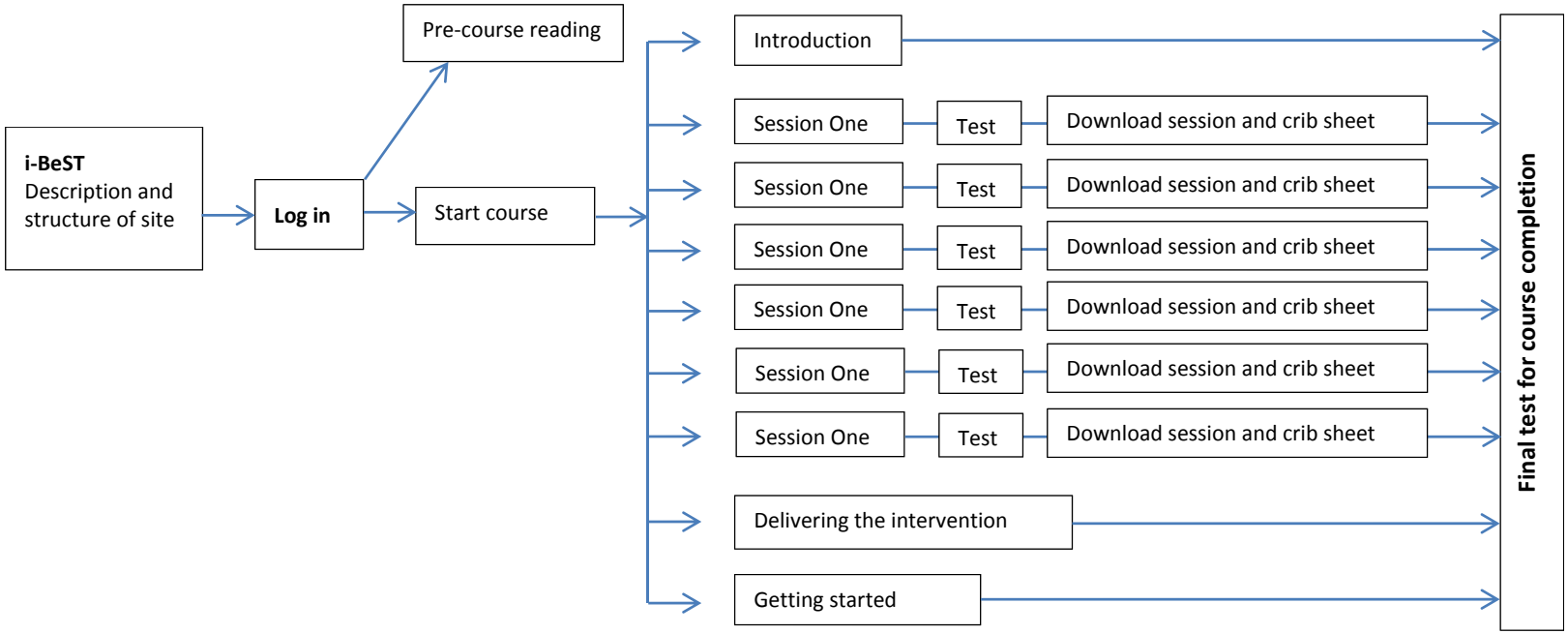
- **Getting Started**

  Providing the content of the patient assessment, as detailed in table 3.2, along with all other downloadable materials including the therapist manual, session narratives, and the supplementary patient packs.

With this structure, the therapists would learn the background in the introduction before progressing on to learn about the sessions. Sessions 1-6 were formatted so that basic knowledge and skills were taught first, with the session narrative presented at the end of the section to download, pulling all the components together. Consistent with stage 8, and

as a means of knowledge re-enforcement through the provision of feedback, each session was followed by a mini test. Figure 2 maps the structure of the first version of i-BeST.

Figure 2. The structure of i-BeST version one



Determining course functionality

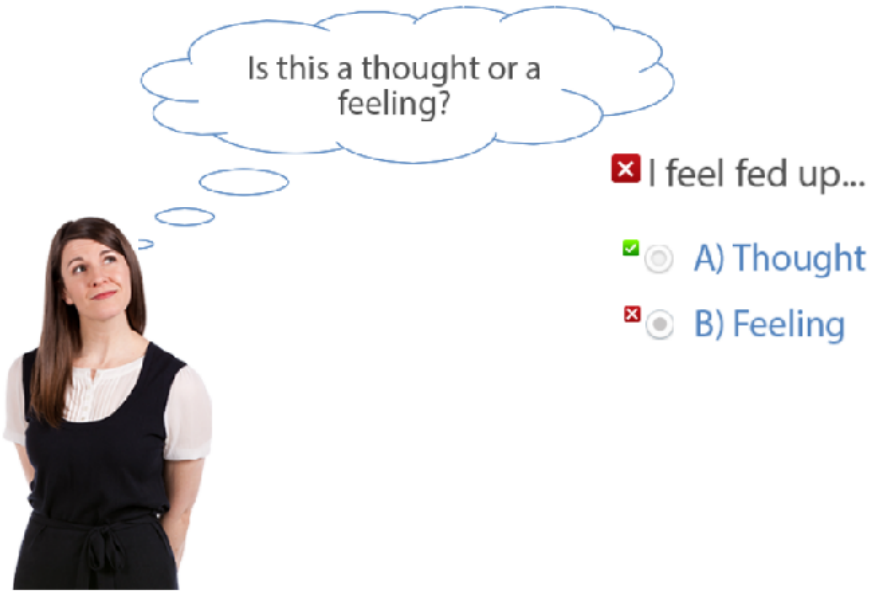
The next stage concerned the challenge of translating the paper based materials produced for the online course, into online course content. To encompass BeST successfully in an online course presented many difficulties. Particular concern arose in strategies to translate the following integral elements from the face-to-face training: reproduction of feedback on performance, role play scenarios to practice skills with feedback from tutor and peers, facility to ask questions, the development of facilitation skills (such as questioning technique), and the ability to generate a good understanding of how the intervention works with the session plans, narrative, manual and patient packs. To begin this process, all sections in the course structure were evaluated for ways in which the information could be presented, and for what forms of functionality, if any, were required. Once this process was complete, a list was produced showing the degree of functionality that was required in the online course (Table 12).

Table 12. A table showing when, where and what functionality the course required

Section	Functionality
Introduction Formulation	Highlight/enlarge vicious cycle; consider using a screencast.
Session 1 Understanding pain exercise	Scenarios presented. Click/select degree of pain and degree of tissue damage. Connect selection with a line.
Session 1 Exercise on mood + pain	Slide bar – ask participant to illustrate how mood/feelings effect pain (no pain one end, sever pain other end).
Session 1 Mini test	Mixture of multiple choice questions (MCQs); drag and drop to complete diagrams, provision of feedback for incorrect answers.
Session 2 Pain fluctuation graph	Animated graph; voice over as line on graph progresses.
Session 2 Formulation	Highlight/flash/enlarge vicious cycle; consider using a screencast.
Session 2 Pacing	Animate with pictures.
Session 2 Baseline setting example	Video of individual walking and timing their walk. Drawing of calculation.
Session 2 Example goal setting	Add pictures (take myself) of person on a gym bike and then a normal bike.
Session 2 Mini test	Mixture of MCQ: drag and drop to complete diagrams, provision of feedback for incorrect answers.
Session 3	Select feelings from selection in boxes according to scenario.

Thoughts and feelings exercise	
Session 3 Identify thought/feelings exercise	Select 'thought' or 'feeling' after reading line of text. Provide feedback on selection of answer (illustrated in Figure 3).
Session 3 Thought diary	None, this exercise is for self-reflection.
Session 3 LBP formulation	Delay in presenting second part of the diagram.
Session 3 Mini test	Mixture of MCQ: drag and drop to complete diagrams, provision of feedback for incorrect answers.
Session 4 Formulation	Highlight/flash/enlarge vicious cycle; consider using a screencast.
Session 4 Relaxation	Use pictures (real or cartoon) to liven page.
Session 4 Mini test	Mixture of MCQ: drag and drop to complete diagrams, provision of feedback for incorrect answers.
Session 5 Clock exercise	Use a picture of a clock (and a bomb) and audio of 'ticking' noise.
Session 5 Mini test	Mixture of MCQ: drag and drop to complete diagrams, provision of feedback for incorrect answers.
Session 6 None	n/a
Clinical skills Questioning styles	Make videos of Zara using questioning techniques.
Clinical skills Example of exploring questions	Produce video demonstrations with Zara.

Figure 3. A screenshot illustrating the functionality required for one interactive element of session 3: multiple choice with feedback



Deciding on the technologies to create and host i-BeST

The budget for the production of the course was small, eliminating the option of programming the content from scratch or using an external company. Using Table 12 as a guide, commercial and open-source software options were informally evaluated, assessing the functionality of each software option against its ease of use and financial cost. The University of Warwick Learning and Development Centre provided a useful starting point for the consideration of online tools by providing a table of desired functionality with example software and tools ((92) appendix 7). The majority of the examples were for components of an online course, for example, tools that can be used to create a standalone forum. For the production of online course content, the resource references SiteBuilder (University of Warwick) and Moodle (version 2.6) as example tools within the University of Warwick, and Coursesites (Blackboard), Glowmaker (London Metropolitan University) and Xerte (University of Nottingham) as examples outside the University of Warwick. Excluding SiteBuilder, all the examples listed in the resource were open-source, meaning they were freely available for anyone to use. When considering commercial e-learning software, Adobe Captivate (Adobe, version 7) and Articulate Storyline (Articulate) were identified as leaders in the market. Table 13 lists the open source and commercial software options that were considered and details the reasons as to they were either included (highlighted in orange) or discarded.

Table 13. A list of open source and commercial software options for creating and/or hosting online content

Software	Purpose (Hosting or content development)	Description	Reasons for using/excluding
Moodle	Both	Virtual Learning Environment (VLE). Provides simple, easy-to-use tools for creating consistent web pages. Can create quizzes and use collaborative learning options (forum, glossary, wiki's).	Tool is limited in functionality for production of online content. Poor aesthetics. Unable to produce screencasts. Good as a medium to host online content developed elsewhere. Provides basic learner analytics. Widely supported and adopted around the world. Chosen and supported by the University of Warwick to host e-learning materials.
SiteBuilder, University of Warwick.	Both	University of Warwick's own web publishing tool. Content is produced and hosted within SiteBuilder. Can produce quizzes and provides some collaborative learning options such as a forum.	Limited scope for customising design beyond set template. Restricted functionality for developing course content. Limited to Warwick University only and therefore content would be 'stuck' in SiteBuilder and not transferrable. Unable to produce screencasts.
Xerte Online toolkit, University of Nottingham.	Content development	University of Nottingham's own open source e-learning authoring software. Server based. Good range of interactions available for delivering content. Provides a range of set templates and pages that must be used.	Limited scope on look and feel of slides/content due to set templates (programmers can create their own personalised templates and pages in Xerte from scratch; this is a different piece of software that can work alongside the online tool kit). Unable to produce screencasts. May require technical support to get the software running on the server. Not supported by the University of Warwick. Content would be lost should Xerte be discontinued.

GLOmaker, London Metropolitan University.	Content development	Similar to the Xerte online tool kit; GLOmaker is a free, open source, e-learning authoring software. It uses Generative Learning Objects to deliver content that can be built or re-used.	There is little room for customisation and a limited range of functionality. Does not have a professional look and feel. As with Xerte, the content would be lost should GLOmaker be discontinued. Unable to produce screencasts.
Coursesites, Blackboard.	Content development	Produced by Blackboard and freely available.	Content developed in coursesites has to be hosted within the Blackboard VLE. Limited functionality for actual production of course content. Not very aesthetically appealing. Unable to produce screencasts.
Adobe Captivate, Adobe Systems Ltd.	Content development	Adobe's e-learning authoring tool. Available for educational use for: £282. Provides a range of interactive elements, templates, characters and quiz building properties. Powerful authoring tool.	Very professional look and feel. Good flexibility allowing content to be designed from scratch if desired. Offers screen casting and good video editing. Reputable company, offering more security than some open-source options. Steep learning curve.
Articulate Storyline, Articulate Global.	Content development	E-learning authoring software. Available for £922. Provides a range of interactive elements, templates, characters and quiz building properties. Powerful authoring tool.	Very professional look and feel. Good flexibility allowing content to be designed from scratch if desired. Offers screen casting and good video editing. More impressive range of interactions compared to Adobe Captivate. Easy to use with interface similar to Microsoft PowerPoint. Expensive.

The above table, whilst not an exhaustive list of all e-learning technologies, provides a brief summary of some of the leading e-learning authoring systems. Articulate Storyline appeared to be the most comprehensive software option for developing e-learning materials, offering extensive functionality and a professional look with easy to use tools.

However, Adobe Captivate was also able to deliver the required degree of functionality for less than one-third of the price of Articulate Storyline. Therefore, Adobe Captivate was deemed most suitable to develop the course content. The content produced in Adobe Captivate needed to be hosted on the internet; therefore, Moodle (version 2.6) was chosen to host the online content, with the rationale for this detailed below.

At the time of producing the course, The University of Warwick were in the process of moving their e-learning materials from their web publishing tool, SiteBuilder, to host them in the virtual learning environment (VLE) – Moodle. In contrast to SiteBuilder, Moodle hosts content produced using any authoring software meaning that the content is transferrable (93). Thus, Moodle effectively packages course content enabling it to be updated, moved and delivered anywhere (93). As detailed in the table above, Moodle also provides the course author with user statistics, is open source (i.e. freely available), and is fully supported by The University of Warwick. Thus, Adobe Captivate was used to develop the e-learning materials, which were then published and hosted within Moodle, the virtual learning environment.

Producing online course content

There was a steep learning curve to reach competence in using Adobe Captivate. Despite the many online tutorials to assist novice users, grasping the new, complex software was challenging and time consuming. The process of creating the content did not run smoothly, with many technical difficulties arising. Despite believing that Adobe Captivate would encompass all aspects of desired interactivity, it was not possible to achieve the variety of interactive learning elements as intended. All diagrams and images produced with Microsoft products (such as Word) from the face-to-face training had to be re-drawn from scratch in drawing software (Quark, version 10), as it was not possible to import them into Adobe Captivate. Additionally, much of the content needed further modification as it was

translated into online material to better suit online delivery. Images were either sourced from freely available pictures on the Internet or purchased from Shutterstock (94) where needed.

The need for technical expertise

Helen Richmond produced all online content in Adobe Captivate, resulting in the distinct modules as per the previously detailed course structure. Following completion of all module content, external technical expertise (Andy Williamson) was sought to set up the online website with Moodle, publish the individual Adobe captivate projects within Moodle, create a user log in interface, and to provide any other technical assistance that was required. During this stage, in conjunction with the technical expert, decisions around the hosting of i-BeST were made. While i-BeST was packaged within Moodle, it was not possible to host i-BeST within the University of Warwick for two reasons. Firstly, since the University were in the process of moving over to Moodle, there was a waiting list within the University to obtain access to it, which would have delayed the production of i-BeST. Secondly, only members of staff at Warwick University could gain access to it for security reasons, prohibiting the use of external expertise. Therefore, a pragmatic decision was made to host i-BeST outside the University of Warwick, which meant securing an external domain name and hosting i-BeST on an external virtual server. The domain name (www.i-best.co.uk) was acquired at no cost and was used for the active duration of i-BeST. The initial choice of virtual server was with EasySpace (93) since it would host i-BeST free of charge.

In an iterative collaboration with the technical expert, the first version of i-BeST (referred to here as version 1), was created. The next stage involved piloting the course to gain user feedback and enable further refinement.

3.3.3 Iterative Development of i-BeST

*Implementation and Maintenance steps 9-10***;** *Cook and Dupras, (83):*

9. *Pilot the website before full implementation.*
10. *Plan to monitor online communication and maintain the site by resolving technical problems.*

Step 9 of the guide identifies testing in a usability lab as the gold standard for piloting an online course. Failing this, the authors recommend assembling a group of learners similar to the target audience to test each component of the course informally. A usability lab was not accessible and therefore the latter option was perused. i-BeST version 1 was piloted with the content experts (Professor Sallie Lamb and Dr Zara Hansen), an e-learning expert (Dr David Davies) and five health care professionals naïve to the BeST intervention (two health care professionals working in an NHS Trust and three senior research physiotherapists from the Warwick Clinical Trials Unit). Individuals were set up on Moodle and enrolled in i-BeST. They were provided with log-in details and a feedback form (appendix 8) to ensure all features of the course were covered including: the course content, the session modules, the mini tests, the use of media, the length of time to complete the course, and operational factors, such as, the structure of the course, navigation, likes/dislikes, and its ease of use. Any technical errors or difficulties were also recorded. The feedback generated from the pilot of version 1 was extremely beneficial and changed the shape of the online course considerably. The key issues generated from the feedback are summarised below.

Publishing

The Adobe Captivate modules in i-BeST version 1 were published in Adobe Flash (Adobe) since several learning objects (activities) were only supported by Flash. However, Flash is a propriety piece of publishing software that is not supported by Apple for use on iOS devices (95). This meant the content could not be displayed on the iPad and iPhone, restricting user

access. Therefore, other technical publishing formats were considered, namely HTML 5, which is the worldwide standard for publishing web-based materials (96). This format has widespread support across all modern web browsers and mobile platforms including iOS devices (96). Thus, HTML5 was the optimal choice for publishing the Adobe Captivate modules in i-BeST, offering greater reliability and support for the future. Therefore, any learning objects in the Adobe Captivate modules that required Flash were modified and version 2 was published in HTML5.

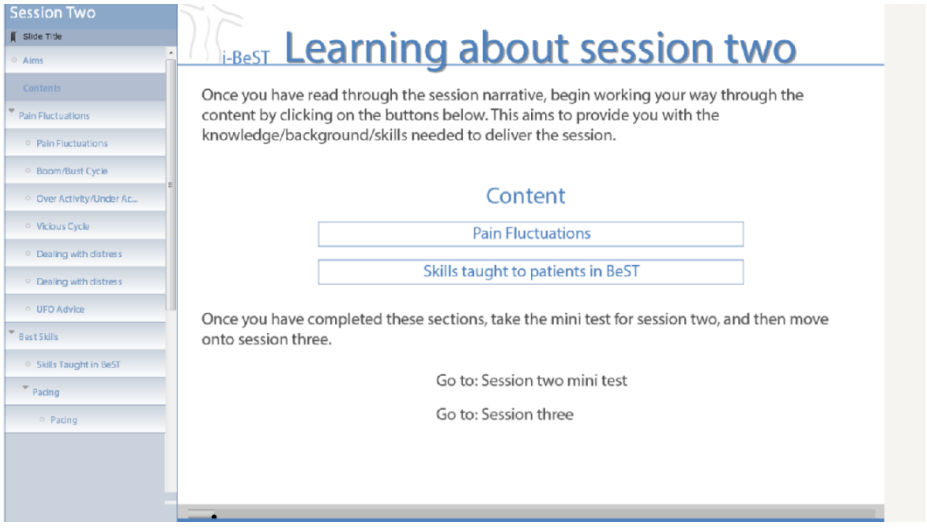
Hosting

Aspects of the online course were slow to load and respond when simultaneous users were using i-BeST. Therefore, a decision was made to move from the virtual server provided by EasySpace (93) to one provided by Amazon (97), since it offer greater capacity and flexibility.

Navigation

In version 1, a user could access a module from the homepage. Once they had finished the module, they had to exit the activity to return to the homepage before then selecting the next module from the homepage screen. This was found to be a cumbersome process that wasted time. Therefore, the navigation was altered to include links to the relevant next sections at the end of each module (Figure 4).

Figure 4. Screenshot showing navigation options at the end of a module



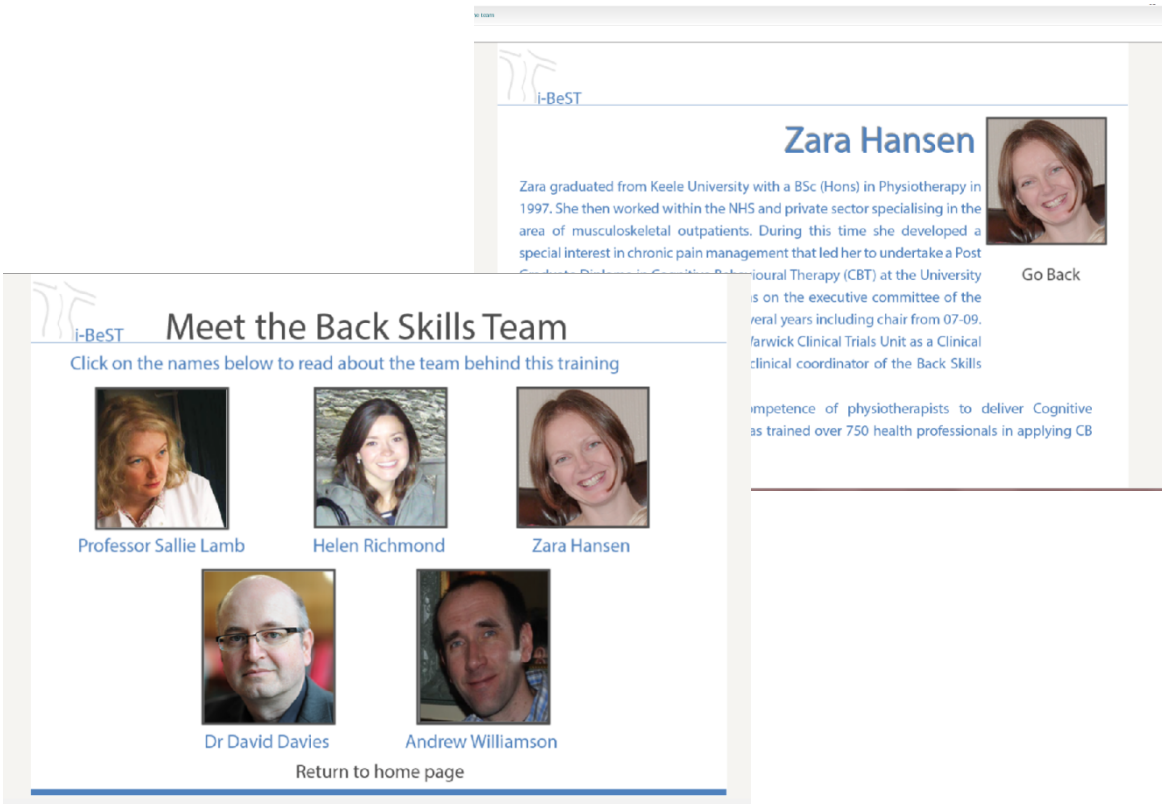
Online tutorials

Version 1 did not include any tutorials to guide users on how to use the course. Feedback suggested that these would be useful to speed up the process of learning how to use the training programme. Therefore, two online video screencasts were produced using Adobe Captivate; the first showed users how to navigate around the homepage and access the course content, and the second demonstrated how to actually work through the course materials.

Meet the team

Prior to logging into the course, version 1 included an 'About Us' section where users could read about the Clinical Trials Unit. However, there was no information regarding the people behind the creation of either the BeST intervention or the online training programme. The inclusion of this information was thought to provide the course with greater credibility and hence a 'Meet the Team' section was added to version 2. This included a picture and brief profile of the people responsible for BeST and i-BeST (Figure 5).

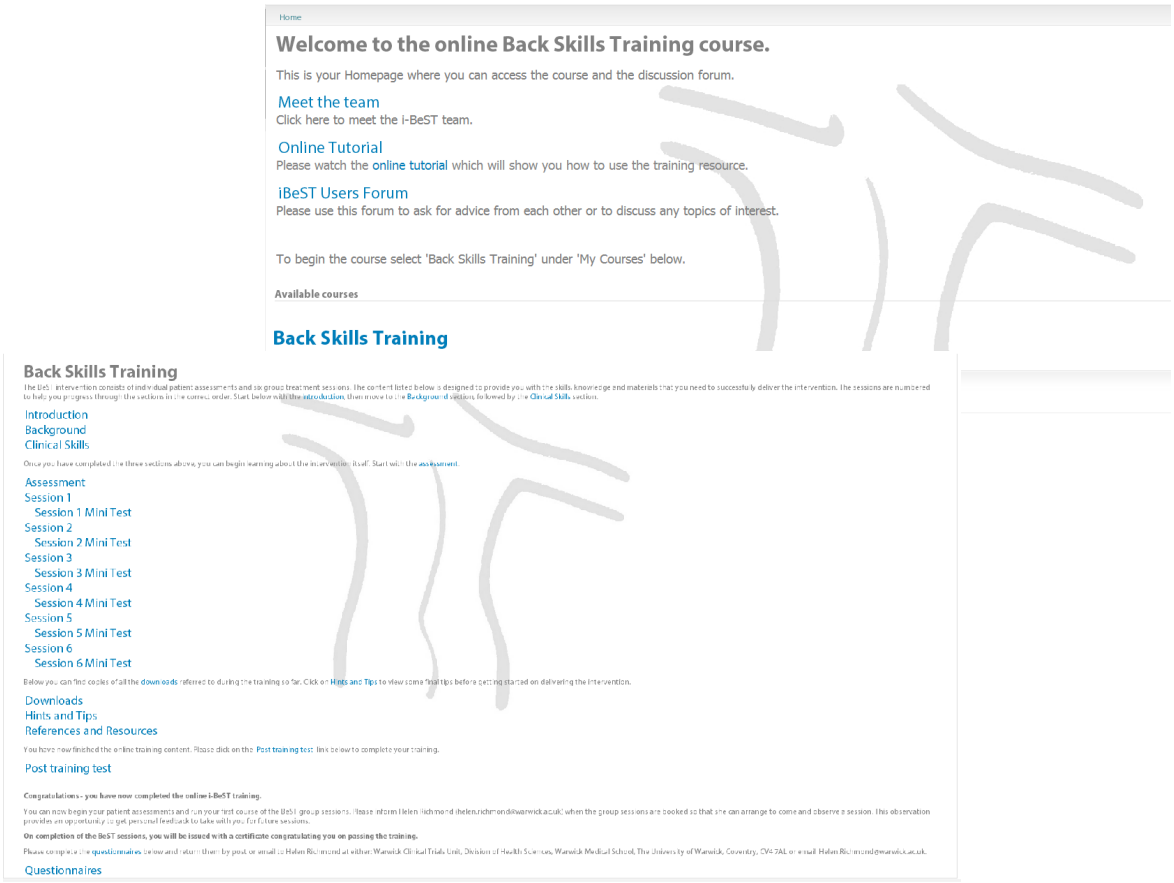
Figure 5. Screenshots showing the meet the team page and an example profile



Structure

The structure of the course underwent extensive change following user feedback; creating new modules and moving content around (see Figures 9 and 10 for course structure maps). One significant change was moving the downloadable session narratives from the end of the corresponding module to be beginning. A key theme reported from pilot users was the lack of context to the module content without seeing the narratives until the end of the module. It was thought that moving them to the beginning would show users what they need to deliver to patients, with the module content then providing them with the knowledge and skills required to deliver the session to patients. This change reflected a move away from the associative learning perspective to one that leant more towards a constructivist learning perspective. Another important change was moving the content from the 'Introduction' to a 'Background' section and using the introduction module as an overview of the course and of the BeST intervention rather than providing the background to CBT. A new module, labelled 'Clinical Skills' was created allowing 'Delivering the Intervention' to be dissolved as the title was thought to be misleading. The patient assessment was changed to an independent module sitting before the beginning of sessions 1-6. Another crucial change was the addition of a 'Contents' page that hosted all of the course materials, leaving the 'Homepage' less cluttered and hosting only a few links (Figure 6). Following these structural changes, i-BeST consisted of 10 core modules, as illustrated in figures 9 and 10.

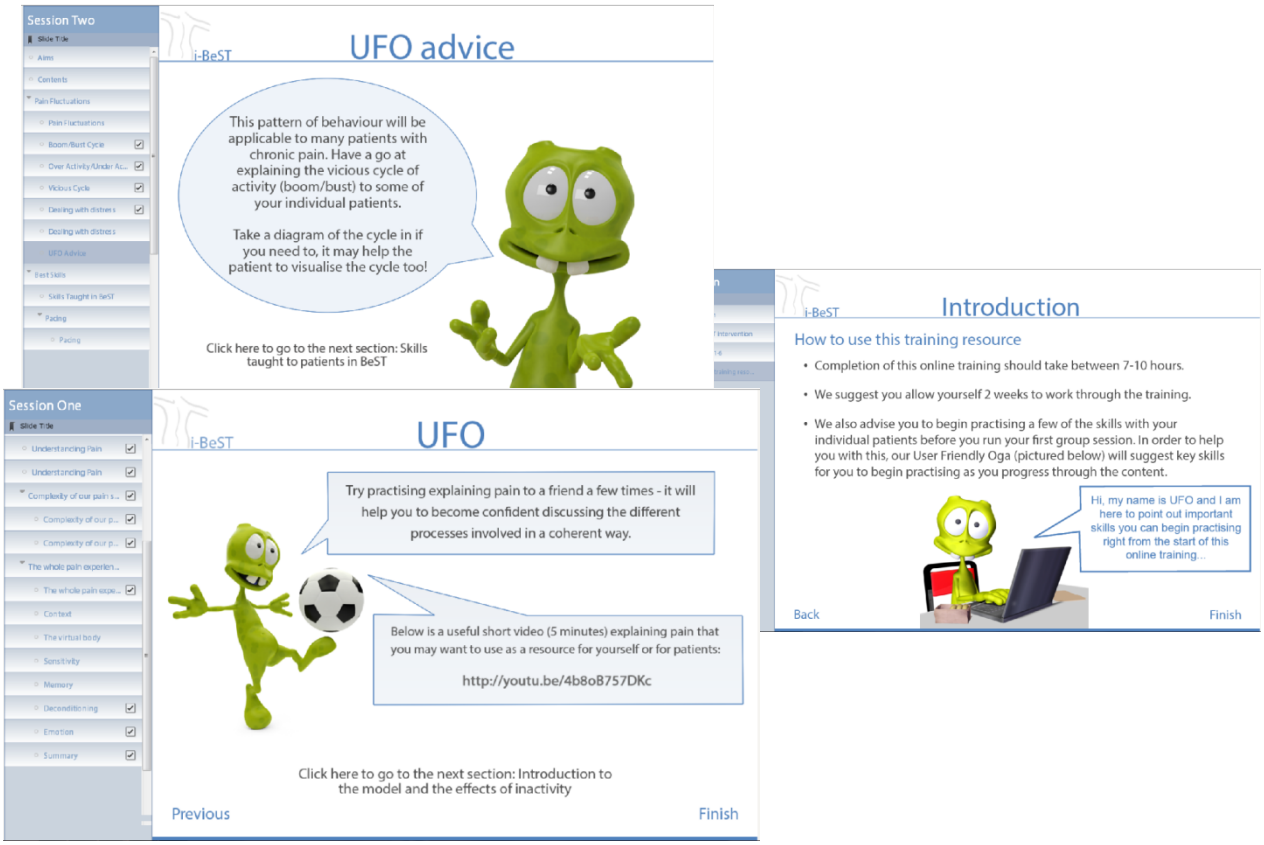
Figure 6. Screenshots showing the Home and Contents pages



Hints and tips

There were many points along the course where users could start practising specific skills as they progressed through the material. To highlight these skills, an illustrated character was used (UFO – the User Friendly Olga) and appeared every time a key skill was covered, providing a means of consistently identifying important key stills. UFO highlighted the skill and offered tips on how to start practising it (Figure 7).

Figure 7. Screenshots showing UFO giving tips for the therapists



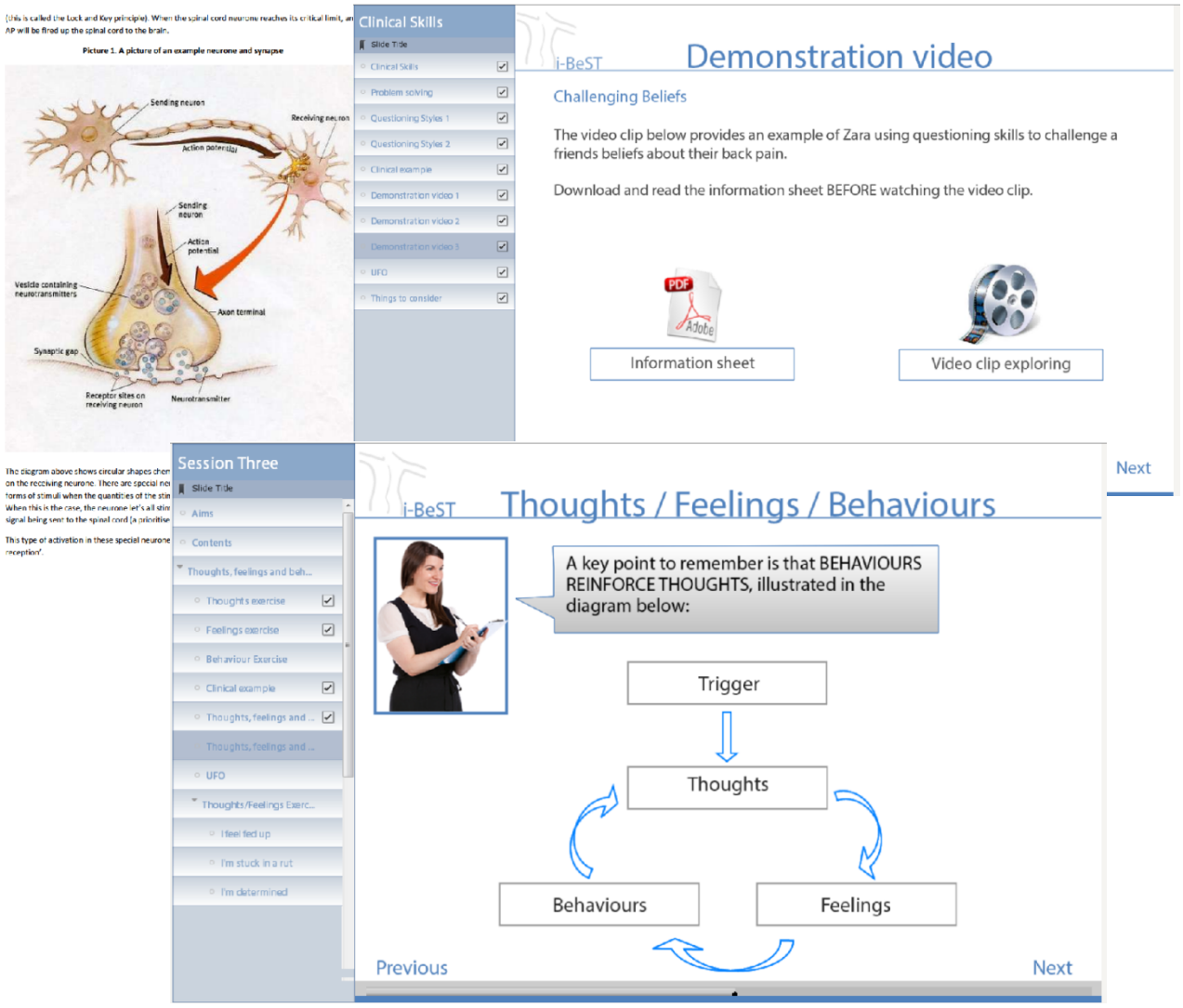
Aesthetics

The aesthetics of the Homepage and Contents pages, as well as the table of contents within each module, were improved. This included modifying the text colour and size, and personalising the theme that was being used in Moodle. Whilst the majority of changes could be made within the Moodle Home and Content pages, the layout of text was still restricted by Moodle's features and no images could be added to these pages. The instructions on progressing through the course were made clearer.

Content

A large proportion of the content was expanded or modified based on the user feedback. For example, the 'explain pain' section in Session One was expanded to include a section on basic neurophysiology before the information about chronic pain was presented. As another example, the Clinical Skills section was expanded to provide more examples and information about questioning styles (examples in Figure 8).

Figure 8. Screenshots showing examples of expanded content



Resources

A resources section was added to provide extended reading and additional web resources should users wish to explore aspects further.

Learner analytics

From studying the user statistics and logs provided by Moodle during this usability testing, it was apparent that Moodle did not provide detailed learner analytics for the individual Adobe Captivate modules. Therefore, the technical expert (Andrew Williamson) authored bespoke learner analytic software capable of recording every mouse click that a learner made within the Adobe Captivate projects. Combining these analytics with the Moodle logs

yielded a comprehensive and detailed record of learners' online behaviour. The analytics could be downloaded anytime into Microsoft Excel from an independent, secured website.

Whilst not an exhaustive list, the points above summarise many of the key modifications to the online course based on user feedback and personal observations. Figures 9 and 10 show the resulting new course structure. The modification and production of i-BeST version 2 was time consuming; however, the iterative process of developing the online course was essential and resulted in the fully operational training programme, ready for evaluation in the next phase of this thesis.

Figure 9. New course structure in i-BeST version two

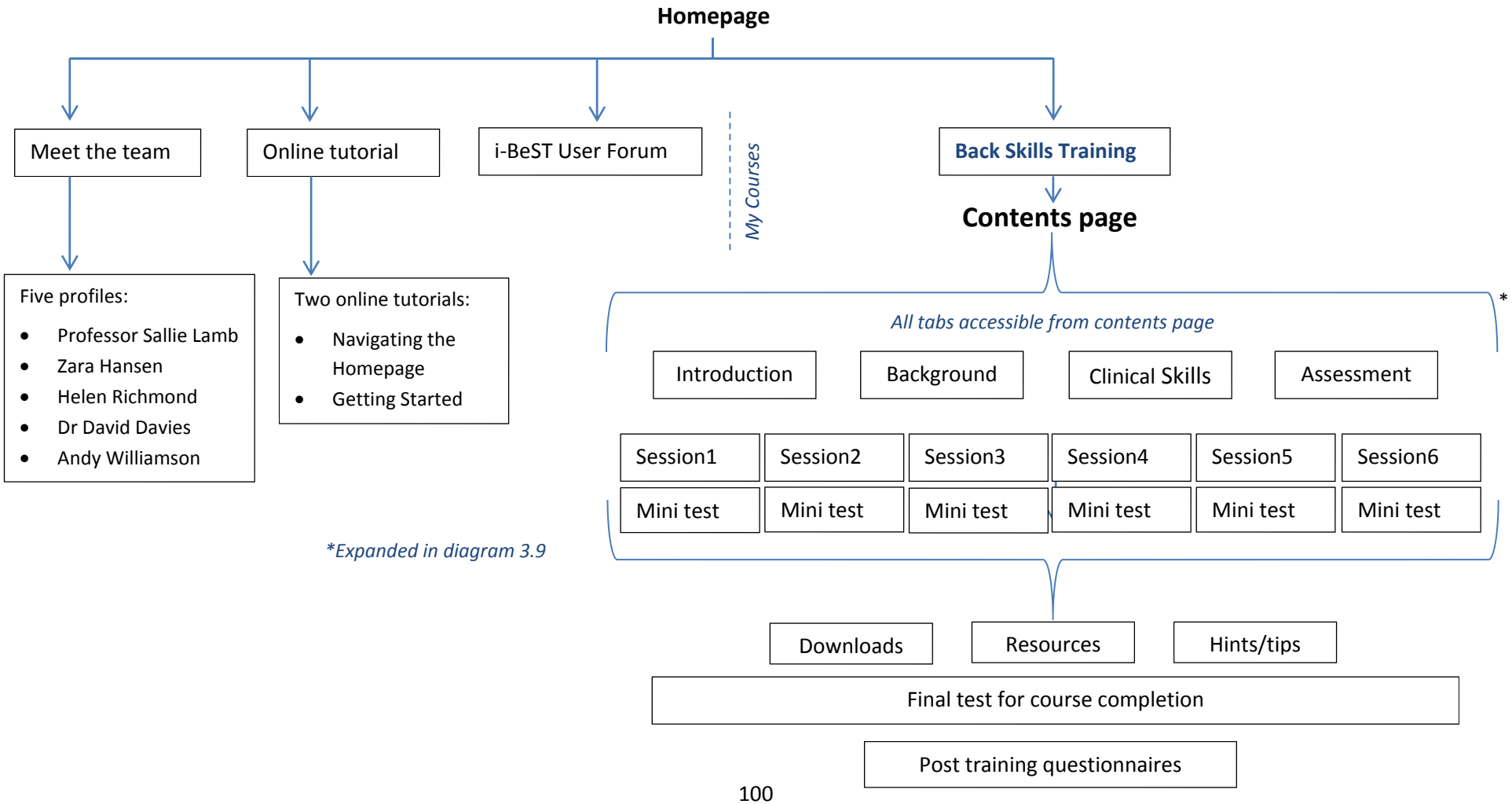
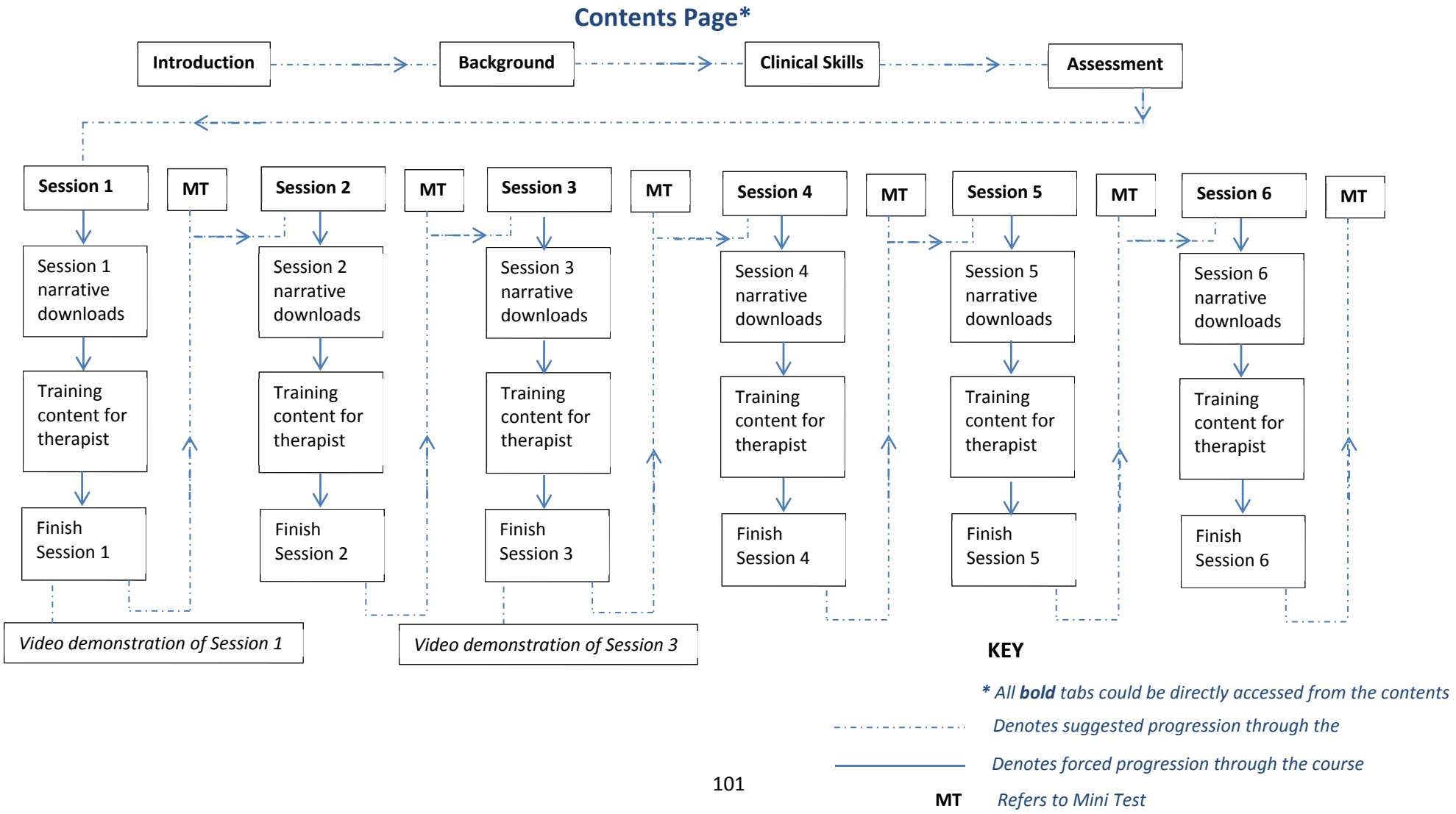


Figure 10. Core modules on the new contents page in i-BeST version two



Chapter 4 - Methodology

Drawing on the findings from the systematic literature review presented in chapter two, chapter four describes and justifies the methodology selected for the evaluation of both online and face-to-face training strategies for the BeST intervention.

4.1 Epistemological paradigm

"The consensual set of beliefs and practices that guide a field"

Morgan (98) (P49)

Traditionally research methodology in health sciences has consisted of two distinct fields, quantitative research and qualitative research, which each hold very different stand points on how knowledge is created (98). The inherent beliefs within each paradigm determine the kinds of knowledge researchers look for and how they subsequently interpret that knowledge (99). Quantitative methodology, based within a positivist paradigm, assumes that there is an objective reality distinct from subjective perceptions or emotion, and that this reality can be understood by objective evaluation that is free of subjective bias (100). Contrastingly, qualitative research draws on the constructivist paradigm, with the belief that understanding is achieved through individuals and their subjective views (101). Historically, quantitative and qualitative research methodologies were used in isolation of each other, with researchers from each field seeking to answer very different research questions, using equally contrasting methods (98). The notion of combining both approaches, and subsequently of integrating paradigms, has been a source of much debate, often referred to in the literature as the 'paradigm wars' (99, 102). However, over time there has been increasing recognition in the value of combining quantitative and qualitative approaches, and mixed methods has emerged as a rigorous methodological framework, often cited as 'the third research paradigm' (99, 103). This thesis draws on

mixed methodology and the remaining sections in this chapter justify this choice of methodology.

Epistemological stance of Helen Richmond

My epidemiological stance as a researcher is pragmatic; therefore, by definition, I believe in methodological pluralism with no allegiance to one particular school of thought (104). In line with this pragmatic stance, I appreciate the strengths and weaknesses of both qualitative and quantitative approaches and advocate that the research question should determine the methods that are employed (105). Thus, whilst I believe that it is essential that we have objective methods to measure and quantify phenomena, I do not believe it is possible to study and understand phenomena with pure objectivity, free from any subjective influence (106). As an example, an objective measure of pain is not void of subjectivity, which would have been innate in the creation of the measure (106). Therefore, rather than viewing qualitative and quantitative methods at opposite ends of a scale, I believe that instead, they represent an interactive continuum, where neither school of thought is truly sufficient in isolation to understand the world we live in (106). Thus, I believe that methodological pluralism is essential, through the pragmatic combination of quantitative and qualitative methods, to advance our knowledge and achieve greater understanding of the world.

4.2 Methodology for the current research project

The aim of this doctoral study was to explore the implementation of the BeST intervention. So far, this exploration has led to the development of an innovative training programme (i-BeST) as an alternative, potentially advantageous, implementation strategy to face-to-face training. The systematic literature review (chapter two) identified that, whilst there is a growing body of literature advocating comparable effectiveness of online training, there is a gap in the literature concerning the effectiveness of this method for training health care

professionals in complex interventions. This gap was exacerbated further in the context of this thesis, since the online programme was required to train clinicians in a complex intervention consisting of knowledge and skills that were inherently different from and outside of physiotherapists' usual scope of practice (20, 21). Therefore, this alternative implementation strategy needed to be formally evaluated.

Evaluation of i-BeST

A wide range of methods are available to evaluate complex interventions, with clinical trial designs ranging from very small, safety observations, to flexible adaptive designs and carefully controlled, large scale randomised controlled trials (107, 108). Thus, the choice of research methods should be guided by the purpose of the evaluation (76, 107). The Medical Research Council (MRC) recommend that interventions are evaluated sequentially (109). This sequence begins with development and exploratory research (phases 1 and 2) and, where appropriate, is followed by explanatory and implementation research (phases 3 to 5) (109). According to these research phases, evaluation of i-BeST aligns itself with the exploratory phase (phase 2), where the main purpose of the evaluation is to explore the efficacy of an intervention. This should be distinguished from research at phases 3-4, where the main purpose is to determine the effectiveness of an intervention. Since efficacy and effectiveness exist on a multidimensional continuum (110), the following definitions apply in this thesis:

- Efficacy: the potential effect of an intervention in ideal circumstances. Therefore, research aiming to explore efficacy exerts more control over the evaluation, such as, restricting the inclusion criteria for participants, monitoring the fidelity of the intervention/s, and measuring a wide range of outcomes at frequent intervals (110).

- Effectiveness: the actual effect of an intervention in real world conditions. Therefore, research aiming to establish effectiveness adopts a more pragmatic approach to evaluation, such as, including a broad range of participants, and using outcome measures that are only collected as part of routine clinical practice (110).

Thus, the evaluation in this thesis sought to explore some aspects of efficacy in using i-BeST to deliver the BeST training and materials, in comparison to face-to-face methods, with regards to the following key objectives:

- The potential effect of i-BeST on learning outcomes (quantitative methods)
- Participant satisfaction with i-BeST as a marker of acceptability (quantitative and qualitative methods)
- Participant experiences of using i-BeST (qualitative)
- The impact of i-BeST on the clinical behaviour (uptake of BeST) (quantitative and qualitative)

Secondary objectives of this evaluation were to:

- To assess the following parameters: participant compliance with i-BeST, and the variability between participants.

In order to achieve the aforementioned objectives, the sole use of either quantitative or qualitative approaches would have been inadequate. Therefore, combining quantitative and qualitative methods was the optimal methodological approach. The use of mixed methods to evaluate online training is also advocated by Cook and Steinert (111), following their review of the literature on online learning for faculty development (medics and nursing populations). They found limited and mixed evidence of effectiveness, and concluded that successful online learning was dependent on the programme itself (what works), the population in which it is being delivered, and the context within which it is delivered. Thus, Cook and Steingart (111) recommended that future work focus on both

qualitative and quantitative investigations to establish the factors that determine user engagement and success alongside evaluations of effectiveness.

Andrew and Halcomb (100) noted that research projects may choose a mixed methods approach to achieve one or more of the following purposes: confirmation, complementarity, initiation, development, expansion, and enhancement of significant/non-significant findings. The evaluation in this thesis sought to use mixed methods to achieve three of the purposes identified above. The first justification for using a mixed methods approach was for confirmation, where the findings from both quantitative and qualitative methods of the same phenomena converge, increasing the validity of the findings (99, 100, 102). The second reason was to achieve complimentary perspectives and use qualitative data to explain, expand and enhance quantitative data (99, 100, 102). Lastly, the use of mixed methods allowed for expansion of the evaluation, whereby the quantitative and qualitative components focus on different aims and thus broaden the scope of the project (99, 100). For these reasons, using mixed methods for the evaluation of the online and face-to-face training implementation strategies was deemed to be the optimal methodological approach.

4.3 Mixed methods evaluation of two implementation strategies

4.3.1 Design considerations

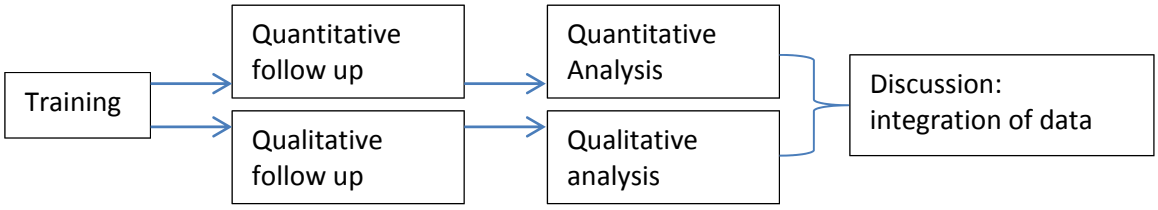
Andrew and Halcomb (100) define mixed methods as:

"…research which collects both qualitative and quantitative data in the one study and integrates these data at some stage of the research process." (p9-10)

There are a number of strategies through which quantitative and qualitative components can be combined to achieve mixed methods research. The strategy used to combine the different components depends upon several factors including the dominance, if any, of one

approach, the sequence of data collection, and the point at which integration of the data occurs (99). The evaluation in this thesis had a dominant quantitative component, with concurrent qualitative data collection. Data were integrated at the interpretation stage (illustrated in Figure 11). Therefore, according to the framework provided by Andrew and Halcomb (100), the evaluation in this thesis was a concurrent triangulation of mixed methods. The methodological decisions within each of the quantitative and qualitative components are justified over the following sections. For clarity, each approach is described separately, with its own aim and set of objectives.

Figure 12. Illustration of study methodology for the evaluation of i-BeST



4.4 Quantitative methodology

Aim

To explore the efficacy of using i-BeST to deliver the BeST training and materials, in comparison to face-to-face methods, with regards to the following key objectives:

- The potential effect of i-BeST on learning outcomes.
- Participant satisfaction with i-BeST as a marker of acceptability.
- The impact of i-BeST on the clinical behaviour (uptake of BeST).
- Participant compliance with i-BeST.
- To assess the variability between participants for future sample size calculations.

4.4.1 Justification of quantitative methodology

Quantitative methodology was most appropriate to determine the efficacy of training health care professionals with i-BeST, in comparison to face-to-face training, and can be justified with several reasons. In order to achieve the study aim, training outcomes needed to be measured on common scales across participants, provide quantifiable data and enable comparisons to be drawn between the online and face-to-face implementation strategies (112). Whilst qualitative data could have provided information regarding training outcomes, the subjective and descriptive nature of the data precludes its standardisation and measurement across participants and therefore, it would not have been possible to quantify between group differences and produce estimates of effect (112, 113). Conversely, quantitative data provides precise, quantifiable measures of effect, and can enable direct comparison of data sets between groups. If appropriate, these data sets can be analysed statistically allowing the researcher to drawn inferences from the data (76, 113). A further advantage of using quantitative data is that data can often be measured using validated and reliable tools, ensuring objectivity and facilitating generalisability (113, 114).

4.4.2 Choice of study design

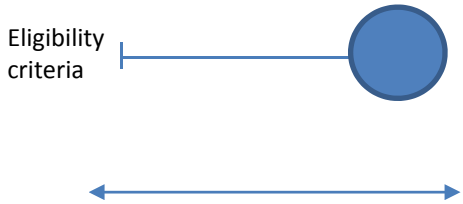
The selected quantitative study design for this evaluation was an exploratory randomised controlled trial.

4.4.3 Justification of study design

This evaluation was concerned with cause and effect since it sought to determine whether manipulating the intervention variable (training method) would cause changes in the outcome variable/s. In order to establish that any observed changes in the outcome variable/s were due to manipulation of the intervention (training method), any potential influence of other factors on the outcome variable/s needed to be minimised as much as possible (112, 115). Thus, the research design needed to be capable of employing methods that minimised any potential confounding of cause and effect through the control of extraneous variables (116). Additionally, in order to show association of cause and effect, a prospective design was needed to ensure that the manipulation of the intervention variable (training method) preceded any changes in the outcome variable/s (112). Lastly, in order to prospectively measure any effect of intervention manipulation, the design needed to be longitudinal rather than cross-sectional (112). Thus, the optimal design to establish the effect of manipulating the intervention variable on the outcome variable/s was a prospective, longitudinal experiment. In particular, experimental designs employing randomisation and the use of a comparison group (randomised controlled trials) enable greater control of extraneous variables and improve accuracy in establishing possible cause and effect. The use of randomisation eliminates bias in the allocation of treatment, maximises the likelihood of having similar group characteristics at baseline, and balances unknown as well as known confounding variables (112, 116). The use of a comparison group puts the effect of the intervention variable in context and provides a reference point from which comparisons can be drawn (117). However, the validity of any comparisons are dependent on the numbers enrolled and followed up in the experiment (112).

Randomised controlled trials (RCTs) can vary greatly depending on the design features that are employed (115). To assist researchers in matching the purpose of their evaluation to the ideal trial design, Thorpe et al (115) produced a multidimensional continuum to assess how explanatory or pragmatic ten key features of the evaluation are (the PRECIS tool). The authors provide a number of factors to consider for each domain to help researchers decide where to place that domain on the explanatory-pragmatic continuum. This process is illustrated for one of the domains, participant eligibility, in figure 12.

Figure 13. An illustration showing how a single domain (participant eligibility) is placed on the explanatory-pragmatic continuum



Pragmatic rim:

- Include all participants who have the condition of interest
- Eligibility is not affected by factors such as anticipated risk, responsiveness, comorbidities, and compliance.

Explanatory hub:

- Use of selection criteria to restrict individuals at risk of unfavourable outcomes
- Criteria to maximise number of individuals thought to respond favourably to the intervention

Since the evaluation of i-BeST was concerned with exploring efficacy, the ideal experimental design was explanatory to ensure greater control of key variables. However, Thorpe et al (115) recognise that experiments are rarely purely 'explanatory' as it is often not possible to control all aspects of an evaluation. Figure 13 represents a retrospective graphical plot of the evaluation of i-BeST according to the PRECIS tool, where each of the ten key domains of the RCT have been rated according to how explanatory or pragmatic they were. The inner circle represents the most explanatory approach for each domain,

while the outer rim represents the most pragmatic approach to each domain. By way of comparison, figure 14 displays the original BeST trial (14) mapped according to the PRECIS tool. These illustrations are the interpretations of the thesis author (Helen Richmond) with regards to how explanatory or pragmatic the design features were in i-BeST and in the original BeST trial.

Figure 14. An illustration showing the how explanatory or pragmatic ten key design features were in the RCT of i-BeST

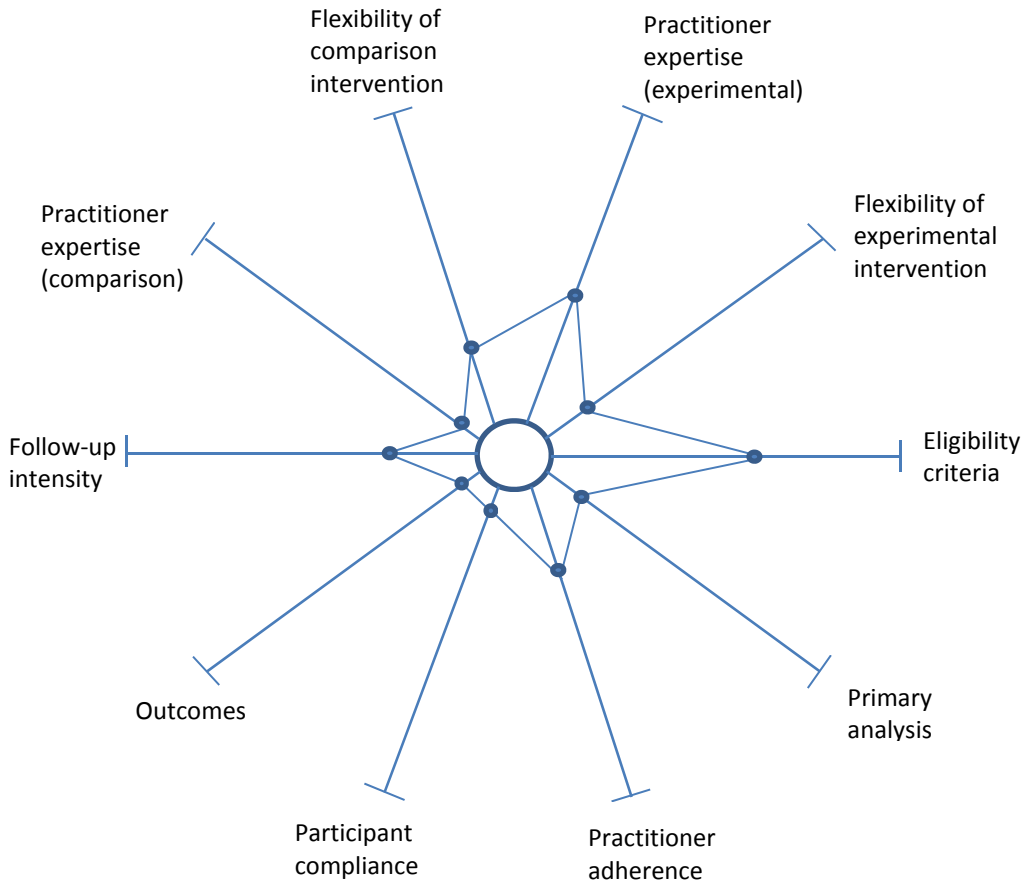
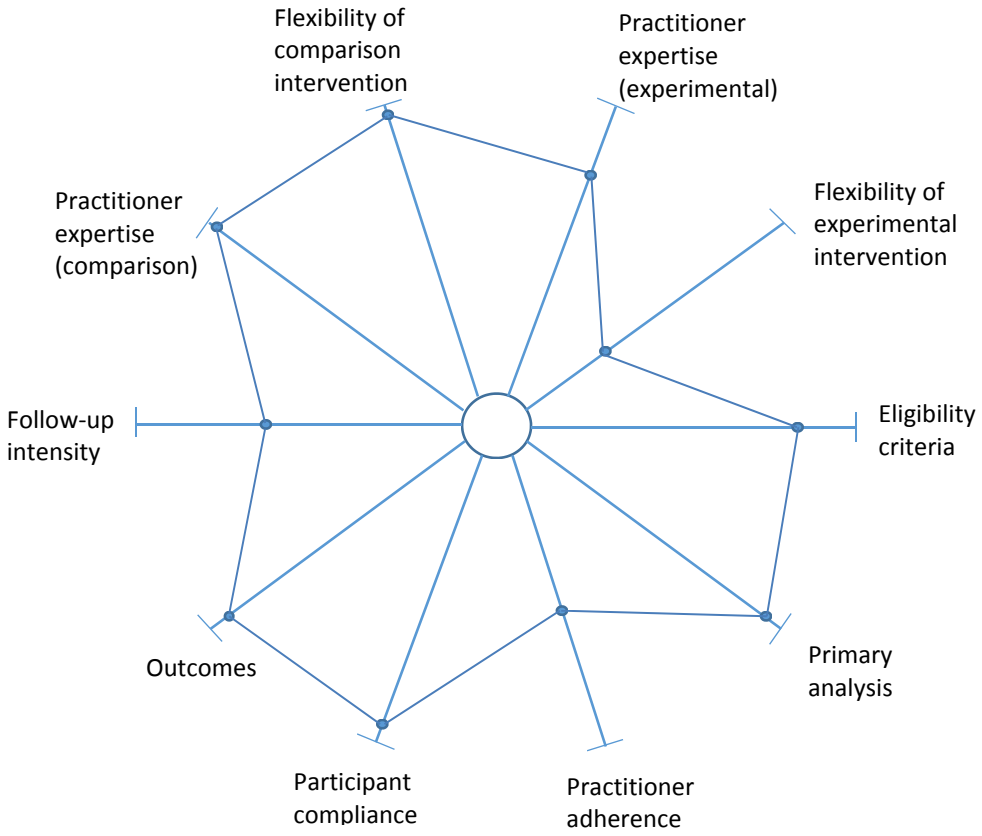


Figure 15. An illustration showing the how explanatory or pragmatic ten key design features were in the original BeST RCT (14)



Whilst the shape in figure 13 does not sit tightly around the inner circle on each of the ten domains, it clearly indicates that the experimental design was explanatory, with participant eligibility as the most pragmatic of the ten domains. In contrast, the illustration in figure 14 from the original BeST trial shows a much more pragmatic research design.

The use of a randomised controlled trial design is also supported in the literature by leading experts in the field of medical education (118). Here, the authors reviewed 110 studies of experimental design that investigated medical education interventions and proposed a framework to classify the designs. The framework used the term 'justification studies' to describe studies that made a comparison with another intervention to establish whether the intervention under investigation was better than, or as good as, the comparator. They noted the importance of these justification studies when evaluating higher order outcomes

(behavioural and patient- or practice-oriented outcomes). Since this thesis was concerned with the evaluation of two methods of implementing the BeST intervention, behavioural and practice orientated outcomes were considered. Therefore, according to Cook, Bordage and Schmidt's (118) framework, a justification study would be the optimal method of evaluation. Additionally, latest guidance from the NHS pertaining to the implementation of technology enhanced learning (81) advocated that future research focus on the effectiveness of online learning on clinical behaviours, thus further supporting the choice of study design described above.

4.5 Qualitative methodology

Aim

To explore the experiences of physiotherapists receiving the BeST training with the online programme i-BeST.

Research Question

- What were the participating physiotherapists' experiences with and perceptions of the online training resource i-BeST?

Objectives

- To understand participants' thoughts on receiving training in the BeST intervention with i-BeST.
- To understand participant training preference and factors influencing future training preferences.
- To learn how i-BeST could be improved for potential future iterations.

4.5.1 Justification of qualitative methodology

Qualitative methodology was the most appropriate methodology for addressing the aim and research question detailed above for a number of reasons. Firstly, it has a commitment to naturalism, seeking to understand phenomena in terms of the meanings people bring to them, and recognises that behaviour is contextual (119). Qualitative methods also focus on the meaning and understanding of phenomena, and employ methods that provide rich and descriptive data that is useful for exploring and understanding experiences (120). Another advantage of using a qualitative approach is the flexibility of the research strategy, where data collection can be continually adapted as early data are analysed (121). Quantitative methodology could have been used to ascertain participants' thoughts and opinions regarding their training experience through, for example, a questionnaire. However, the narrow depth of the data (scores on questionnaires) would only allow a limited understanding to be gained (119). Other forms of quantitative methodology, such as a

clinical trial, would have been inappropriate since this aspect of the evaluation did not seek to establish effectiveness or to compare groups of people (122). Thus, with the aim of gaining an in-depth understanding of participants training experiences with i-BeST, qualitative methodology was used to provide data that was both rich and descriptive.

4.5.2 Selected study design and data analysis choice

Semi-structured, one to one interviews analysed with an inductive thematic analysis that drew on grounded theory.

4.5.3 Justification of study design

Qualitative one-to-one semi-structured interviews were conducted. The interview guide was based on recent systematic reviews (52, 58) and the thematic framework by Carroll et al (123), developed from a thematic analysis of online learning strategies to enhance health care professionals learning experience. The interviews were face-to-face rather than over the telephone, as this allowed the interviewer to see and reflect upon facial expressions and body language (124). Face-to-face interviews were also advantageous since they facilitated the building of a good rapport with the interviewee, thus potentially yielding more information than interviews over the phone (120). Semi-structured interviews were chosen over structured or un-structured interviews. The advantages of using semi-structured over structured interviews were that the interview guide allowed for flexibility, discussion, and depth of information, rather than forcing the interviewer to follow a set of questions in a specified order, limiting probing and resulting in more succinct answers (125). The flexibility of semi-structured interviews allowed the interviewer to ask questions that were not written down and to explore areas of particular importance to the interviewee. Semi-structured interviews also provided advantages over un-structured interviews since the interview guide maintained focus around the research issue (121) and thus ensured that all key aspects were covered.

One alternative to interviews would have been to use focus groups to gather the data, which could have captured a range of opinions and experiences together (125). This may also have had the advantage of a synergist effect, revealing more information by drawing on others ideas (121, 125). Focus groups would have also enabled the researcher to explore group dynamics and may have provided more naturalistic conversation (119). However, in order to gain greater depth of information on individual experiences and to probe possibly sensitive areas, such as low self-efficacy or poor proficiency with computers, one-to-one interviews were considered the most appropriate method of data collection. It would not have been appropriate to use observational methods to answer these research questions since they would not provide any information on individual experiences and training preferences (119, 120, 125).

4.5.4 Justification of data analysis

There are multiple approaches to analyse qualitative data (119). The most salient to the current research project are discussed below (thematic analysis, framework analysis, realist analysis and grounded theory).

Thematic analysis (TA)

In its simplest form, a TA of the data is the most basic method of qualitative data analysis (119). TA aims to identify, analyse and report themes within the data and follows four stages (126). At stage one the researcher familiarises themselves with the data by reading transcripts and listening to interview tapes; at stage two they begin generating initial codes, usually a word or succinct phrase that summarises a section of language (119, 127). At stage three the researcher looks for themes (a sentence or phrase that is the outcome of coding and reflection) and at stage four these themes are reviewed to consider their validity in relation to the whole data set (126). Themes can be identified inductively, deductively or through a combination of both methods. While TA is often viewed as a basic

form of analysis to merely describe a data set, Braun and Clarke (126) argue that TA can be used for a richer form of analysis, particularly through the identification of latent themes, offering interpretation of the data, rather than superficial description. Despite this, it is questionable as to whether TA would provide sufficient richness and depth to draw any interpretive conclusions from the data (119).

Framework analysis (FA)

This method of data analysis can obtain a deeper exploration of the data than a TA and is popular in health care research, primarily since it is well suited to the development of policy and practical strategies (119). In FA, data are analysed deductively within a theoretical framework that already exists (127). A central principle in FA is that the collected data retains its integrity and is left 'whole' (127). Thus, the first stage of framework analysis is familiarisation with the data through reading transcripts and listening to interviews (128). Once the researcher is familiar with the data in its entirety, thematic analysis is conducted to develop a coding scheme (collection of themes with their sub-categories) (128). This coding scheme is then applied to the whole data set (indexing), which is subsequently charted to allow for comparison within and between cases (127, 128). The final stage of framework analysis, known as mapping and interpretation, involves looking at the relationships between the codes through the use of diagrams and tables, revealing associations between the concepts (119, 120).

Realist approach

Another method, growing in popularity within the medical education literature, is the realist approach. Realists seek to explain regularities (outcomes) by asking what mechanisms are responsible for the regularity (outcome) in the given context (129). To conduct data analysis using a realist approach, the researcher must deductively produce hypotheses of change (mechanisms) that explain the behaviours and interrelationships of

processes responsible for the regularity (outcome) within the given context (129). Thus, hypotheses are created following the model of context, mechanism and outcome (CMO configurations), which are then tested on the data set. Hypotheses can be generated from the literature, past examples, existing theories, and through consultation with relevant experts or stakeholders (130). Both the realist approach and FA are deductive in nature, working from the literature and known theories and applying these to the data. Thus, both approaches were ruled out on two bases. The first is that published literature in this specific field and context is sparse, making it difficult to either select a theoretical framework (FA) or to build hypotheses. Secondly, Bernard and Ryan (128) argue that the study of human experience is always exploratory and thus advocate using an inductive approach to data analysis.

Grounded theory (GT) – theoretical standpoint

This approach is both an inductive and deductive method of data analysis and is widely used in health care research. It is inductive in that theories are generated from the data, as opposed to the deductive realist and framework approaches where theories are tested against the data (119). However, due to the iterative nature of GT, where data is collected, analysed and coded simultaneously, with each process informing the other, it is also deductive in its nature (131). Traditional GT requires the researcher to remain detached from the data and to be abstract in the field, putting aside all prior knowledge and personal perspectives (131). This purist stance has been widely criticised, particularly by researchers in the constructivist paradigm, whom acknowledge that the researcher has an essential role in the construction of knowledge through interaction with the participants and the data (131). As a result, various branches of GT have evolved, each with slightly different epistemological viewpoints (101). Charmaz (132) proposed a constructivist GT, whereby researchers and participants create data together, interactively, and that the end goal

shifts from one of trying to discover truth, to one of achieving adequate understanding (132).

Grounded theory (GT) – methods

Regardless of the theoretical standpoint in GT, the methodological processes are the same (101). GT methods state that data should be coded right from the first interview. This process, known as 'open coding', refers to a concentrated line by line analysis of a transcript, fracturing and opening up the data (125). These codes are referred to as conceptual labels rather than descriptive summaries, which hold properties and dimensions (119). The researcher should also look for 'in vivo codes', referring to codes that participants use to define and categorise their own world (128). Once an initial coding scheme has been developed, axial coding begins, where the fractured data are joined together again (119). This stage allows the researcher to look for relationships between categories. Following this process, the final stage of 'selective coding' is commenced. Here, core categories should emerge as the researcher moves towards producing concepts that are more abstract, analytical and theoretically informed (128). This level of data analysis requires asking questions of the data to define the underlying story (131).

Throughout the process of grounded theory data analysis, the researcher should continually challenge and develop theoretical insights, paying particular attention to deviant cases (128, 131). Constant comparative analysis, where the researcher continuously moves between emerging theory and data, is a key process in data analysis to generate grounded theory (128). The inductive and deductive nature of grounded theory implies that the emerging data and data analysis determines which cases should be interviewed next, known as theoretical sampling (119). Bernard and Ryan (128) suggest that sampling ends at the point of theoretical sufficiency, since a researcher can never truly know if theme saturation has occurred. Whilst using GT would have inductively produced a

rich, deep analysis of the data, it was not plausible for use in this thesis. To conduct grounded theory proficiently not only requires expertise in the field of qualitative research, it also requires considerable time (119, 126). Since this work was being completed within a relatively short time scale, by a novice qualitative researcher (Helen Richmond), GT was not deemed the most suitable method of analysis. Additionally, whilst an inductive approach was desirable, the researcher could not enter the data collection and analysis without any existing ideas or pre-conceptions given their involvement in the development of the intervention concerned.

Selection of data analysis for the qualitative evaluation in this thesis

Many of the principles and some of the methods used in grounded theory were used to aid the data analysis in this thesis (119). Therefore, the interview transcripts in this study were analysed using an inductive thematic analysis that drew on two elements of constructivist grounded theory. Open coding was used to identify the range of concepts used by participants and to produce categories, thereby extending the analysis and ensuring that the identified themes were grounded in the data (115, 121). Secondly, constant comparison and close attention to deviant cases also facilitated the analysis through providing a structure to look at relationships between categories (124).

4.6 Stage of planned data integration

Integration of both quantitative and qualitative data is essential and is often cited as the heart of mixed methods research (133, 134). Bazeley (134) suggests that true integration has taken place when both data sets are mutually informative, producing a 'negotiated account of what they mean together' (p: 27). However, considering its importance, there is a paucity of mixed methods projects actually achieving true data integration (104). In a review of 232 mixed methods research articles, published between 1994 and 2003, only 18% of articles genuinely integrated quantitative and qualitative research findings (135).

Bryman (104) interviewed 20 social researchers and concluded that a lack theoretical and practical guidance in how data integration should be performed was a key barrier precluding researchers from integrating their data sets.

A pragmatic orientation is frequently adopted regarding data integration, with the chosen strategy dependent upon the aims and different components of the research project (106, 136). Tashakkori and Creswell (136) stipulate that mixed methods projects need an explicit research question or objective that directly refers to the nature of integration. Thus, for the mixed methods evaluation in this thesis, both data sets were analysed independently and jointly interpreted to achieve the following objective:

- To use qualitative data to provide illumination and expansion of quantitative findings from the evaluation of i-BeST.

In order to achieve this objective, both data sets were compared to determine the degree of complementarity between them (100). Since both data were complimentary, where possible, qualitative data was used to illuminate and expand upon each quantitative outcome to achieve a more comprehensive and meaningful understanding of the quantitative findings (104, 134).

4.7 Summary

This chapter has described and justified the use of mixed methodology for the evaluation of two implementation strategies for the BeST intervention. It has also detailed the reasons behind the selected quantitative and qualitative components. The next chapter details the quantitative methods (chapter five) for the RCT and is followed by the study results (chapter six). Following this, the qualitative methods are provided (chapter seven), followed by the qualitative results (chapter eight). This segmented method of reporting is the most common method of reporting mixed methods studies and is recommended for

novice mixed methods researchers (Andrew and Halcomb, 2009). The integration of qualitative and quantitative data is presented in the discussion (chapter nine).

Chapter Five - Quantitative Methods

This chapter details and justifies the methods used for the quantitative aspect of the mixed methods evaluation. For reference, the chapter begins by re-stating the aim and study objectives detailed in chapter 4, section 4.4.

5.1 Aim

To explore the efficacy of using i-BeST to deliver the BeST training and materials, in comparison to face-to-face methods, with regards to the following key objectives:

- The potential effect of i-BeST on learning outcomes.
- Participant satisfaction with i-BeST as a marker of acceptability.
- The impact of i-BeST on the clinical behaviour (uptake of BeST).
- Participant compliance with i-BeST.
- To assess the variability between participants for future sample size calculations.

5.2 Trial Design

As described and illustrated in section 4.4, this was an exploratory randomised controlled trial.

5.3 Study setting

The study took place at the University of Warwick and outcomes were collected from participants at eight NHS Hospital Trusts from May 2013 until December 2013.

5.4 Eligibility criteria for participants

Participants were eligible if they met the following inclusion criteria:

- Physiotherapist working in the NHS.
- Access to a patient population with persistent LBP (pain of more than 6 weeks duration).
- Willing to implement the BeST intervention (individual patient assessments and 6 group sessions).

- Access to a computer either at home or at work for completion of the i-BeST training programme.
- Able to attend a workshop for training on the 14th-15th May at the University of Warwick.
- Willing to receive either form of training.

5.5 Description of interventions

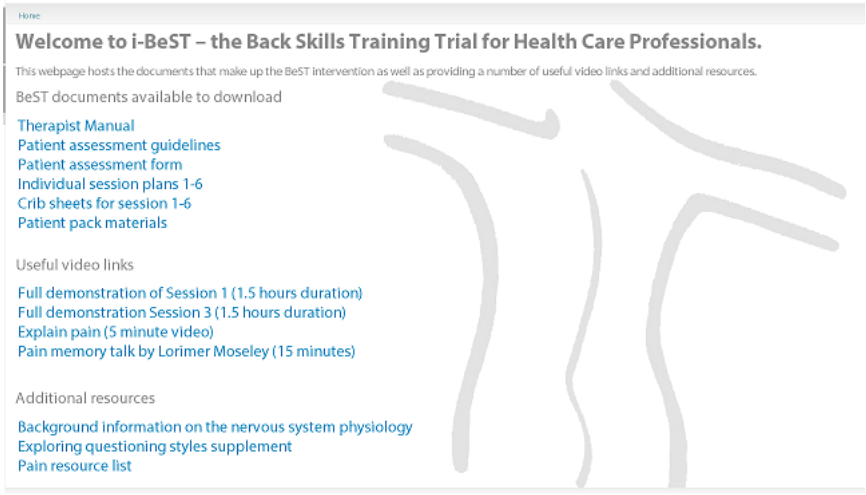
Both implementation strategies aimed to train physiotherapists to deliver the BeST intervention, described in chapter one of this thesis. Therefore, participants received identical content in both training arms, provided through two different mediums. Briefly, the content consisted of:

- An introduction, whereby the BeST trial was introduced and the evidence base behind the BeST intervention was discussed.
- A background section, where a brief history of CBT was presented and key concepts and theories of a CB approach were explained.
- Information on the clinical skills needed to deliver the BeST intervention, including the adoption of a discursive style, group problem solving skills and the use of exploring questions.
- Guidelines and information on how to conduct patient assessments for the BeST intervention.
- Detailed narratives for each of the six group sessions, along with the background theory and knowledge needed to deliver each of the sessions. This included the following topics: explaining chronic pain, the effects of inactivity, goal setting, pacing, baseline setting, the over activity/under activity cycle, the effect of thoughts and feelings on pain and behaviour, fear avoidance, the hypervigilance cycle, relaxation techniques, and coping with flare ups.

5.5.1 Face-to-face training

Participants randomised to the face-to-face training attended a 2-day face-to-face course at the University of Warwick in May 2013. The training was delivered by a physiotherapist specialising in CBT, who led the training in the original BeST trial (36) and has been training physiotherapists in a CB approach for the last nine years. The delivery of the training consisted of PowerPoint presentations, video clips, role play scenarios, discussion and feedback. Lunch was provided along with morning and afternoon refreshments. Participants were reimbursed for their travel expenses. Following the training, participants were given access to a website where they could download additional forms, such as patient packs or the therapist manual (Figure 15).

Figure 16. Screen shot showing the website accompanying the face to face training



5.5.2 Online training (i-BeST)

i-BeST has been described in detail in chapter three of this thesis and is therefore not described here. Participants allocated to the online course were emailed their user name and password, along with a brief guide to help them get started. The online course was available 24 hours a day and could be accessed at any time. Participants were asked to start the course within two weeks of receiving their log in details and were allowed up to the end of June 2013 (6 weeks) to complete the training. The restricted time frame prevented participants from starting the course and delaying its completion. If needed, participants were sent email reminders of the completion date. Due to problems gaining access to the online programme at one site, participants were allowed an additional 4 weeks to complete the training (end of July 2013).

5.5.3 Adherence to training

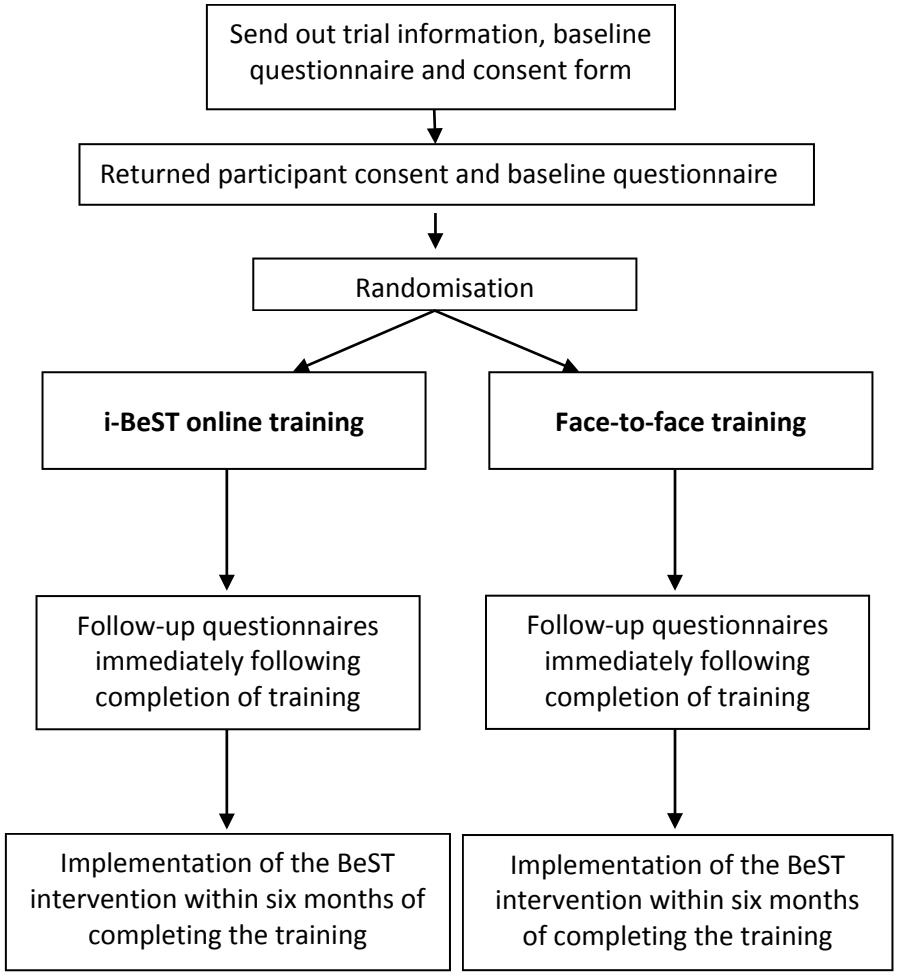
Since both training methods differed significantly in their delivery of the training content, compliance could not be measured using the same strategy for both groups. Attendance at the face to face training was monitored using a signed register. Participants were said to have adhered to the training intervention if they attended both of the face to face training days. Adherence of participants in the online training arm was monitored using learner analytics. Participants accessing over 50% of each core module were said to have adhered

to the online training programme. Those not meeting this criterion were contacted via email to inform them that they would not be issued with a training certificate since they had not completed over 50% of each core module. They were able to access the programme and complete the training if they wished within a negotiated time frame.

5.6 Trial procedures

The flow of participants through the study is illustrated in Figure 16 and detailed over the following sections.

Figure 17. Overview of participants flow through the study



5.6.1 Identification of participants to randomisation

Physiotherapists belonging to the Midlands research network mailing list, along with clinical departments that Warwick University had previously collaborated with, were sent an advertisement for the study and asked to contact the researcher (Helen Richmond) for more information. In addition, the study was advertised via a physiotherapy social network site. Interested therapists and departments were then sent the following information: a participant information sheet (appendix 9), an eligibility questionnaire, a baseline questionnaire and a consent form. Consent was obtained from health care professionals for: recruitment into the trial, recording (audio) of a group treatment session, and the use of anonymised data. On return of these forms, pre-randomisation checks were carried out to ensure that participants fit the eligibility criteria and were not randomised in error.

Allocation to intervention arms (i-BeST or face-to-face training) was provided by an external researcher who used a computer generated randomisation sequence (detailed in section 5.9). Participants were contacted via email to inform them of their allocation. There was no verbal interaction with participants at this stage unless they requested a discussion or if there if there were queries from the baseline questionnaire.

Contamination

It was not practical to only accept one participant from each centre. Therefore, where multiple participants from the same centre were recruited, participants were asked not to discuss the intervention or study with their colleagues if randomised to different training arms. However, this was not strictly enforced or measured since any discussion with peers would have reflected the reality of clinicians' everyday practice.

5.6.2 From randomisation and follow-up to the end of the study

Participants randomised to the i-BeST training course were provided with a user name, password and instructions to get them started. Those randomised to the face-to-face training were reminded of the training date and venue details. On completion of the two-day face-to-face training course, before leaving the premises, participants completed self-reported questionnaires for: satisfaction, knowledge, self-efficacy and their attitudes and beliefs towards chronic low back pain patients (section 5.7). Online participants were asked to complete the same questionnaires on completion of their online training and to return them via email or post. An email reminder to complete and return the questionnaires was sent after two weeks if the questionnaires had not been returned. Following this, participants were contacted via telephone and sent further email reminders to prompt return of the questionnaires.

Participants were then given a six month period to organise and set-up the BeST intervention in their clinical practice. Once the dates for the BeST group sessions had been

set, the researcher (Helen Richmond) liaised with the physiotherapist to attend one of the sessions to observe and audio record it (detailed below). This observation enabled informal, on-site, feedback to be provided to the participant, and allowed an opportunity for discussion and problem solving. Within two weeks of the session observation, the audio recording was listened to and scored, and participants were sent detailed feedback on their performance (appendix 10). Thus, this final stage of assessment provided a means of clinical observation, opportunity for supervision, and the provision of more formal written feedback. All of these factors have been shown to improve the adoption of interventions in clinical practice (27) and improve clinical competency (43, 48).

Set up of the BeST group sessions

Consent for the audio recording of a treatment session was also obtained from the patients attending the BeST session that was recorded. One of the outcome measures for this study (detailed in section 5.7) was the clinical competence of the physiotherapist in delivering the BeST intervention. To assess their competency, the researcher observed and audio recorded one of the six group sessions. As a consequence of this, the voices of the patients attending that session were also captured on the audio recording. Therefore, the treating therapist provided patients with an information sheet detailing the reasons for the recording (to assess the therapist, appendix 11), and provided them with a consent form. Any patients not willing to have their voice recorded may still have taken part in the group sessions and chosen not to attend the session that was recorded.

Data Collection and management

Personal data collected during the trial was handled and stored in accordance with the 1998 Data Protection Act, ICH and MRC good clinical practice guidelines. Access to stored information was restricted to the researcher, Helen Richmond.

Participants were assigned a unique trial number. Personal identifiable information was held at Warwick Clinical Trials Unit (WCTU) in a secure office. This information was filed separately from all other trial information. Paper records of participant details were retained to facilitate participant follow-up.

Paper and online clinical report forms (CRFs) were designed by the researcher (Helen Richmond). Data was anonymised and single-entered by the same researcher onto a secured Excel database. The validity and accuracy of data entry was checked by an external researcher (Catherine Lawrence) independent from the study (20% of baseline data entries and 20% of follow-up data entries), as per WCTU standard operating procedures (SOPs).

Post-randomisation withdrawals and exclusions

Participants could withdraw from the trial at any time without prejudice. If a participant chose to withdraw from the trial intervention, participants were followed-up wherever possible and data was collected as per protocol until the end of the trial. The only exception to this was if a participant also explicitly withdrew consent for follow-up.

5.7 Outcome measures

5.7.1 Baseline demographics

A number of baseline characteristics were collected at baseline, prior to randomisation. These included: participant contact information, gender, job title, length of time worked in profession, age range, degree of experience with CBT/a CB approach, and questions pertaining to eligibility (including access to patient population with persistent LBP, willing to deliver the BeST intervention, access to a computer, ability to attend the face-to-face training date, and willingness to receive either form of training). Participant training preference was also collected prior to randomisation. The demographic characteristics detailed above were collected to provide a means of assessing the similarity of the groups at baseline. Collection of these variables enabled exploration of the results according to

specific factors such as participant age range, to assess the impact, if any, of this variable on outcome variables. The remaining baseline factors were potential confounding variables, such as prior experience with CBT, and were therefore measured to ensure comparable distribution of these variables across groups and to allow exploration of these variables in the results.

Participant training preference was recording at baseline for a number of reasons. Firstly, preferences prior to randomisation have been found to impact upon the internal and external validity of a trial, as well as directly and indirectly influencing measures of effectiveness (137). These effects are likely to be exacerbated in un-blinded trials, particularly where subjective outcome measures are used (138). Preferences have also been shown to influence participant expectancy regarding the effectiveness of interventions (139). Resentful demoralisation is another, frequently cited, potential effect of preference, whereby a participant either consciously or unconsciously performs less well in their outcome response (137). Contrastingly, those allocated to their preference may show greater motivation, improved compliance, and report better outcomes (138). Exactly how much preferences impact on these multiple factors is not known (137). However, for interventions such as professional education and training that require active, motivated participants to fully engage in the process of the intervention, the scope and size of preference effects may be far greater (139). Therefore, it was important to measure preference prior to randomisation to assess the impact, if any, of preference on outcome variables.

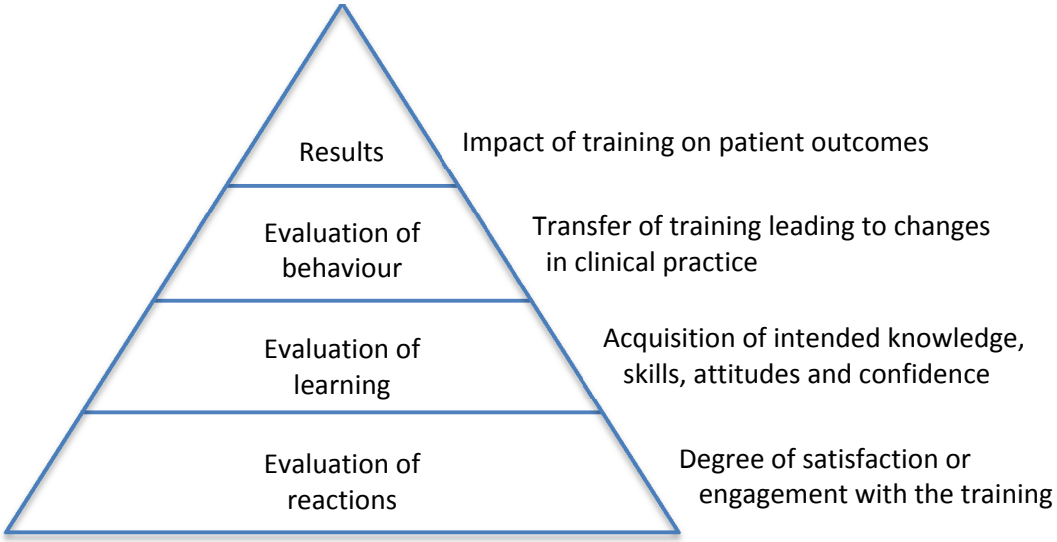
5.7.2 Training outcome measures

Overview

Since this study aimed to conduct a pragmatic exploration of two implementation strategies, a range of outcome measures were selected to evaluate both the comparable effectiveness of i-BeST for training physiotherapists in the BeST intervention, and to

compare the effectiveness of both implementation strategies as a whole. A widely accepted approach to the evaluation of training, as previously discussed in chapter two, is the four-level model proposed by Kirkpatrick (61). Since its unveiling over 50 years ago, the model has been updated to expand the definitions of each of the four levels (140), shown in Figure 17. The levels progress sequentially, with level one measuring the simplest outcomes from a training programme, participants' reactions, such as their satisfaction or engagement with the training. Level two refers to participants learning - how much they have acquired the desired knowledge, skills, attitudes and confidence. Becoming more complex, level three evaluates the transfer of knowledge, skills or attitudes into practice, thus measuring behaviour change. Kirkpatrick noted that this level is usually measured through observation and at three to six months following the training (137). Lastly, level four refers to the desired results of the training, in this instance, patient related outcomes.

Figure 18. Kirkpatrick's four-level model for evaluating training programmes



Kirkpatrick advocated that evaluation of training programmes should measure outcomes at each level of the model sequentially with the ultimate aim of reaching level four, deemed to be the most advantageous level of evaluation (137). However, as Cook and West (141) caution, the link between therapist behaviour and patient outcomes is not direct, with

multiple confounding variables at play, potentially diluting training effects. Thus, evaluation of a training programme based on patient outcome measures would require very large samples to detect the diluted training effects (138). Additionally, Cook and West (141) highlight that much can be learnt from outcomes in line with levels one to three, suggesting that educators need to first ensure that participants behaviour can be influenced by a training programme, before progressing further to assess patient effects.

Since this was a small exploratory study with a restricted time frame, it was not appropriate, nor desirable, to assess patient outcome measures. Therefore, outcome measures were selected in line with levels 1-3 of Kirkpatrick's four-level training evaluation model (62). With reference to level three, it was important to assess the actual behaviour of participants in relation to both the number of participants implementing the BeST intervention and their clinical competency in doing so (detailed below). When considering level two evaluation measures, it was important to assess change (if any) in the attitudes and beliefs of participants, their self-efficacy to perform the desired skills, and their knowledge of the BeST intervention (detailed below). Participants' engagement and satisfaction with the training, level one measures, were also assessed to ensure that outcomes at all three levels were included.

Kirkpatrick's evaluation model: level three outcome measures

Implementation of the BeST intervention

The number of participants setting up and delivering the BeST intervention was recorded. This enabled comparison of baseline and outcome variables between those delivering the groups and those not.

Clinical competency in the BeST intervention

Competency was measured using the Cognitive Therapy Scale – Revised – Pain tool (CTS-R-Pain; appendix 12). This tool has been specifically modified to measure competency in the use of a CB approach among non-psychology specialists (142). Hansen (139) found the tool

to have high internal consistency (Cronbachs α = 0.99) and good inter and intra-rater reliability (intra-class correlation coefficient for intra-rater reliability = 0.92 (0.79; 0.97) and inter-rater reliability amongst 4 raters = 0.82 (0.30; 0.99)).

Once a participant had arranged the dates for their BeST group sessions, a randomly selected group treatment session (1-6) was audio taped and evaluated using the CTS-R-Pain scale. A novice rater (Helen Richmond) and an experienced rater (Zara Hansen) both independently scored the first three audio recordings, resolving any disparities through discussion, to ensure consistency. The novice rater then assessed all further recordings.

Scoring

The tool consists of 15 items, each assessing a key competency of the CB approach. Participants are scored on a scale of 0-6 for each item. Narrative descriptions and examples of each level are provided to help guide the rater.

Interpretation

A higher score indicates greater competency, ranging from a score of zero, categorised as 'incompetent', to a score of six, categorised as 'expert' (Figure 18). All 15 items were not necessarily scored, for example, item 15 was only scored if it occurred during the session. Therefore, the total score for each participant was constructed from the mean of all scored items.

Figure 19. Categorisation of CTS-R-Pain competency scores

Competency level		Examples
Incompetent	0	Absence of feature or highly inappropriate performance
	1	Inappropriate performance with major concerns evident
Novice	2	Evidence of competence, but numerous problems and lack of consistency
Advanced beginner	3	Competent, but some problems and/or inconsistencies
Competent	4	Good features, but minor problems and/or inconsistencies.
Proficient	5	Very good features, minimal problems and/or inconsistencies
Expert	6	Excellent performance, or very good even the face of patient difficulties

Kirkpatrick's evaluation model: level two outcome measures

Attitudes and beliefs towards the management of chronic LBP patients

Mutsaersa et al (143) describe attitudes as underlying properties that effect behaviour, synthesised from multiple beliefs. Evidence suggests that the attitudes and beliefs held by practitioners can influence both their treatment recommendations and their perceptions of their patients (144, 145). Thus, a key aim of the BeST training programme was to shift the attitudes and beliefs of participants away from the traditional biomedical model of health, towards a more psychosocial model of health. Therefore, it was important to measure the attitudes and beliefs of participants regarding the management of chronic LBP patients before and after their training.

Two widely used tools for assessing attitudes and beliefs are the Health Care Provider's Pain and Relationship Scale (HC-PAIRS (145)) and the Pain Attitudes and Beliefs Scale for Physiotherapists (PABS-PT (144, 146)). Since its initial development, the 20-item PABS-PT

scale was further validated to a 19-item tool and tested in multiple populations and contexts, showing good reliability and validity (143). In addition to its wider use, and in contrast to the HC-PAIRS, the PABS-PT scale measures psychosocial (9 items) as well as biomedical factors (10 items). A recent systematic review (143) found the PABS-PT scale to be responsive to the educational intervention being tested in all of its included studies.

Therefore, the PABS-PT scale (appendix 13) was used prior to and following the training to measure participants' biomedical and psychosocial attitudes regarding the management of chronic LBP.

Scoring

Participants scored 19 items (statements) on a six-point Likert scale ranging from totally disagree (score 1) to totally agree (score 6).

Interpretation

Responses to 10 of these items are collated to give a score for the biomedical factor (factor one), which has a range of 14 to 84. A lower score indicates that the participant holds less biomedical attitudes and beliefs towards the management of chronic LBP. To calculate the psychosocial factor, responses to 9 of the items are collated, which has a range of 6-36. Again, a lower score indicates that the participant holds less psychosocial attitudes and beliefs to the management of chronic LBP. Therefore, following the training, the desired response was to see a decrease in the participant's biomedical score (factor one), and an increase in the participant's psychosocial score (factor two).

Knowledge

Adequate knowledge of the BeST intervention, including its underlying rationale and principles, was essential for the individual to both adopt and deliver it (32).

Participants' knowledge of the BeST intervention was assessed following the training using a self-developed multiple-choice questionnaire (appendix 14). Face and content validity of

the questionnaire was enhanced by devising the questions from the BeST training material and matching them to each aim of the training programme (26). The questionnaire was also piloted with a content expert (Dr Zara Hansen).

Scoring

Participants gave either a single or multiple responses as instructed per question.

Interpretation

The maximum score available was 31. One point was awarded for each correct score. Where multiple responses were asked for, one point was awarded for each correct response, and half a point was deducted for each incorrect response.

Self-efficacy

Self-efficacy is a belief in one's ability to perform a given task in a specific context and constitutes a significant parameter in behaviour change theories (147). Individuals reporting high self-efficacy are more likely to adopt and commit to delivering an intervention regardless of the obstacles they are presented with (32) , suggesting that self-efficacy plays an important role when aiming to achieve changes in an individual's behaviour. Therefore, participant self-efficacy to implement the BeST intervention assessment and group sessions into their clinical practice was evaluated.

Bandura (148) warns against the use of an 'all purpose' measure of self-efficacy, stating that these generic scales have limited predictive ability and, since they are detached from any given context, have little informative value. Thus, self-efficacy scales need to be tailored to the particular behaviour that is being studied. Since this study wanted to evaluate participants' self-efficacy to deliver a specific intervention, a measure was developed that was specific to the BeST intervention that included two 10-point likert scales. Attention was paid to the wording of the scale, ensuring the use of 'can do' to signify capability (145).

Scoring

Participants marked a line with a cross to indicate how confident they were to firstly, conduct a BeST patient assessment, and secondly, to deliver a BeST group session.

Interpretation

On a scale of 0-10, a higher score equated to greater confidence.

Satisfaction

Poor compliance and non-completion are recognised obstacles to successful online learning (149). Learner satisfaction has been shown to correlate with user engagement, intention to use, and compliance with the training programme (150). Additionally, Sun et al (77) stipulate that participant satisfaction is a key outcome for establishing the success of implementation. Therefore, measuring participant satisfaction was important to ascertain any association with engagement and compliance, and to explore acceptability of the training methods.

Satisfaction with training was assessed using a self-developed questionnaire asking participants to record their level of satisfaction, ranging from very unsatisfied to very satisfied. Free text boxes provided space to detail likes, dislikes and suggested improvements (appendix 16).

Learner analytics

Learner analytics were recorded for participants in the i-BeST training arm to establish their engagement with the online programme (detailed in chapter 6a). This included detailed logs of online behaviour such as duration of log-ins, slides accessed, length of time per slide and materials accessed/downloaded.

5.7.3 Time points

Participants were given six months in which to set up the BeST group sessions. Therefore, clinical competency was assessed within six months of completing the training. All other

outcome measures were assessed at baseline and/or immediately following the training (Table 14).

Table 14. Outcome measures collected with corresponding time points

Domain in Kirkpatrick's model	Measures	Assessment points		
		Baseline	Immediately after training	Within 6 months of training
Level three	Implementation of BeST			✓
	CTS-R-Pain			✓
Level two	Knowledge test		✓	
	Attitudes and beliefs	✓	✓	
	Self-efficacy		✓	
Level one	Satisfaction		✓	
	Learner analytics		✓	✓
	Baseline demographics	✓		

5.8 Other training

There was a possibility that participants could have received additional training of rel evance to the assessment of competency in delivering the BeST intervention. Whilst this information was not formally captured outside of those being interviewed, participants were informally asked about any additional training they might have received.

5.9 Randomisation

Sequence generation

Participants were randomised on an individual basis using a computer generated random number sequence to determine the allocation of the interventions. An independent statistician generated the random number sequence in Microsoft Excel (Dipesh Mistry).

Randomisation type

The randomisation sequence was stratified by centre to ensure that therapists from the same centre were allocated equally to the intervention and control arms.

Allocation

An external researcher (Catherine Lawrence) held the allocation sequence, which was concealed with sequential opaque envelopes, and was responsible for allocating participants to the intervention and control groups. Following allocation, Helen Richmond (HR) then informed the participant of their allocation and sent out the relevant information according to that allocation.

Blinding of intervention allocation

Whilst the allocation sequence was concealed from the study researcher (Helen Richmond), they were responsible for the management of the trial and all data collection and therefore, it was not possible to blind the study researcher to the allocated intervention following randomisation. However, several of the outcome measures were self-reported and were therefore completed by participants independently of the study researcher.

5.10 Sample Size

This was an exploratory study to explore the efficacy of i-BeST. No formal sample size calculation was performed, however, based on a published literature, a total sample of 30 participants was considered to be sufficient to assess variability between participants and provide an estimate of possible effect (151, 152). This was a small study, so the size of the intervention effect was unlikely to be estimated with great certainty. Therefore, this exploratory study aimed to recruit a 15 participants to each group. To allow for a 15-20% drop out rate, a total of 35 physiotherapists were recruited.

5.11 Statistical Analysis

Statistical reporting followed the latest CONSORT guidelines for reporting of parallel group randomised trials (116). All statistical analyses were conducted using SPSS (IBM; version 21).

Descriptive analyses

Descriptive analyses reported the number of participants approached, the number of participants meeting the eligibility criteria, numbers agreeing to randomisation, the number completing training, and the length of time taken to complete the online training. Descriptive statistics were also reported from the learner analytics (chapter 6a).

Statistical analyses

This was a small exploratory trial and therefore statistical analyses were of an exploratory nature. The following methods were used to explore between group differences:

- For continuous outcome measures, data were plotted using histograms to assess proximity to the normal distribution (76) and equality of variance was measured using Levene's test (114). When these assumptions were met, mean differences between groups were analysed using the Students t-test due to the small sample of participants (76). Although the sample size was small, where data met the assumption of being normally distributed, parametric methods were used for these analyses. This approach is advocated by Bland and Altman (153), who warn that non-parametric methods do not have sufficient power to detect potential significant differences in small samples. Therefore, they advocate using parametric methods, suggesting that the most likely effects of using these methods in small samples are a loss of power to detect any significant differences and the production of wide confidence intervals, as opposed to spurious significant findings (148).

Data with a skewed distribution were transformed to establish a closer resemblance to the normal distribution (76, 114). Where normal or transformed data did not meet the assumptions of the t-test, one of two strategies were employed:

- Equivalent non-parametric methods were used, in this case, the Man Whitney-U test (76).

Consistent with the CONSORT guidelines, all estimates of effect were provided with 95% confidence intervals (154). An alpha of 0.05 was used as guide for interpreting the statistical significance of effect estimates (76). Selecting a smaller alpha level would have further reduced the risk of incorrectly rejecting the null hypothesis and committing a type 1 error; however, this would also have increased the risk of falsely accepting the null hypothesis (type 2 error). Bland (76) advises that an alpha of 0.05 is the conventional compromise for managing the risk of committing either error, and was therefore used in this thesis.

Standardised mean differences (SMDs) were reported with 95% CIs to aid comparison of the groups and give an indication of effect size (60, 112). These were both calculated manually using the formula proposed by Hedges and Olkin (155) in Yang and Dalton (156) (appendix 17). Where outcome measures were collected at baseline and again at follow-up, the mean change in scores were adjusted to account for participants baseline score. This was achieved by using this baseline score as a covariate in an analysis of covariance (ANCOVA) (114).

Due to the small sample size and low expected cell count (cells with an expected count of less than five), categorical outcomes were analysed using Fishers exact test for association (76, 114). Where a statistically significant association was found, each category was analysed against the remaining categories to explore where the significant association was.

Planned sub-group analyses

Participants prior training preference could have impacted upon their engagement with the training programme (137, 139). Therefore, the results from outcome measures were stratified according to those allocated to their preference, those not receiving their preference and those with no preference. For greater clarity, these categories were further grouped into: those receiving their preference or with no preference, and those not receiving their preference. In both cases the sub groups were summarised with descriptive statistics (mean and standard deviation).

5.12 Ethical Considerations

Trial Supervision

Since this was a small exploratory study involving physiotherapists training, there was no Trial Steering Committee or Data Monitoring and Ethics Committee. The study had a trial management group, consisting of the researcher's supervisory team (Professor Sallie Lamb and Dr David Davies).

Ethical arrangements

Ethical and governance approval was granted from the University of Warwick's Biomedical and Scientific Research Ethics Committee (BSREC; reference number 244-10-2012) and from all hospital research, development and innovation (RD and I) departments (8 NHS Trusts) via the Integrated Research Application System prior to study commencement. To ensure confidentially, all study documentation identified participants by a unique study number, and were otherwise anonymised. Recordings, transcripts and other data capture forms were kept in a locked filing cabinet in a locked office in compliance with the Data Protection Act (1998) and the Standard Operating Procedures of the Warwick Clinical Trials Unit.

Good Clinical Practice

The trial was conducted in full conformance of the principles of the "Declaration of Helsinki" (1964) (as amended in Tokyo, Venice, Hong Kong, South Africa and Scotland), the Medical Research Council (MRC) Good Clinical Practice Guidelines, and applicable UK legislation.

5.13 Sponsor

The study was sponsored by the University of Warwick.

5.14 Trial administration

The trial was coordinated from WCTU. The researcher (Helen Richmond) was responsible for all trial management duties and for the day to day running of the trial.

5.15 Trial Registration

This study was registered with the Controlled Clinical Trials database (number: ISRCTN82203145).

5.16 Essential Documentation

A trial Master file was held securely at the coordinating centre (WCTU), in accordance with WCTU SOPs. All sites were issued with a trial site file.

Chapter 6 - Results

6.1 Recruitment

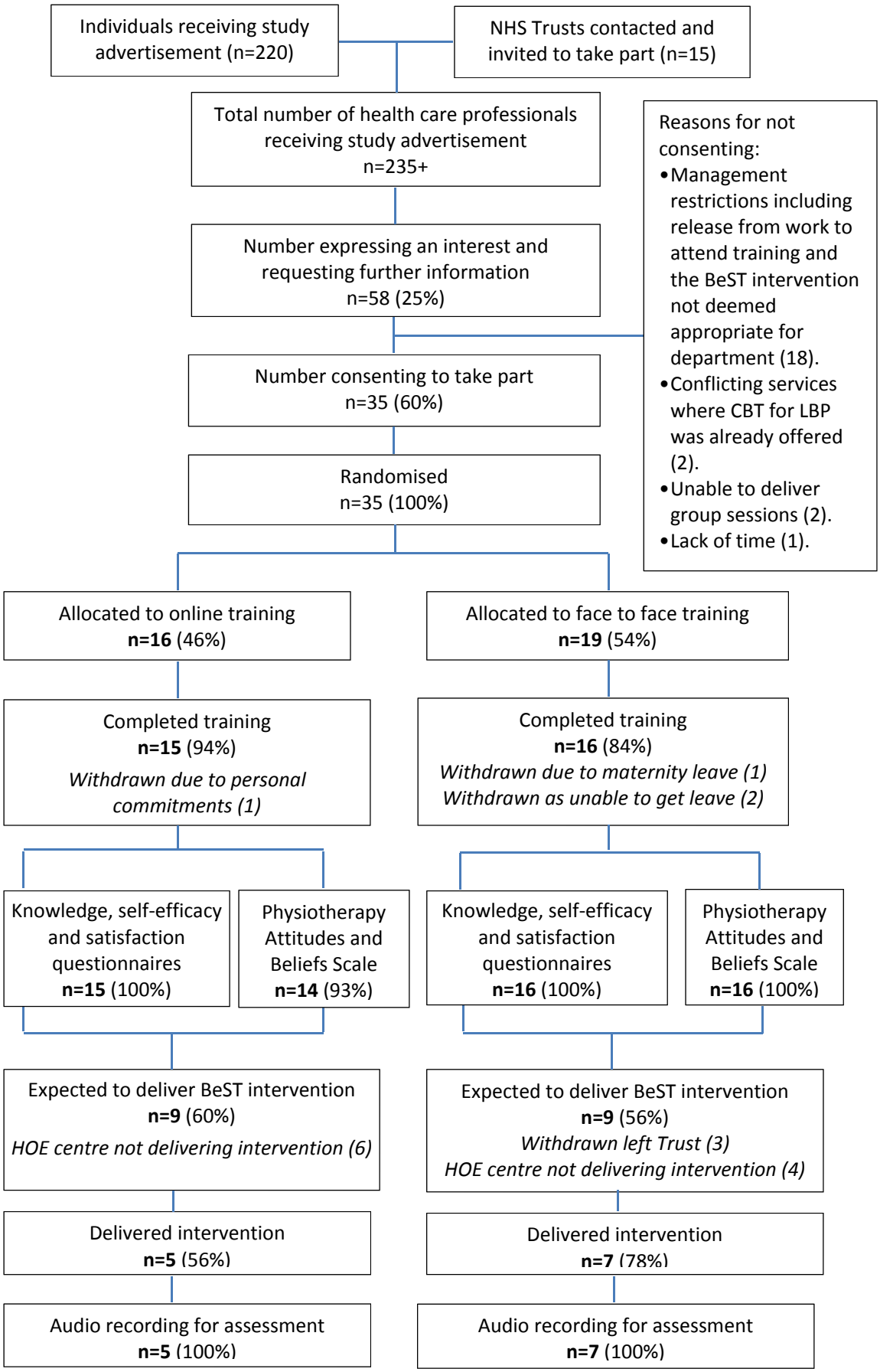
The flow of participants through the trial is detailed in Figure 19. Participants were recruited over a 5 month period, from November 2012 to March 2013. The study advert reached a minimum of 235 health care professions, of whom 58 requested further information. From these initial respondents, 35 health care professionals, from eight NHS Trusts, completed and returned the study consent form and baseline questionnaires. All met the eligibility criteria and were subsequently randomised to receive either online training (16 therapists) or face-to-face training (19 therapists). Prior to attending the face-to-face training, three participants withdrew from the study as they were no longer able to get the leave from work (2) or would not be in employment due to maternity leave during the duration of the study (1). Therefore, 16 therapists completed the face-to-face training which ran over two days in May 2013. One participant withdrew from the online training due to personal commitments, leaving 15 therapists in the online group. The online training course was available from April, with all training completed by the end of June 2013.

Following the training, questionnaires were collected immediately in the face to face group and were returned via post or email on completion of the course in the online group. All questionnaires were returned excluding one PABS-PT questionnaire. One centre, the Heart of England NHS Foundation Trust, stated that they would no longer be able to deliver the BeST intervention following the training due to conflict with their current LBP pathway. Since all participants from this site (10) had already been randomised and only a few days remained before the face-to-face training, the participants were left in the study with the agreement that they would complete all other outcome measures excluding the audio recording of the BeST treatment session. Thus, from a pool of 31 participants, only 21 were

expected to deliver the BeST intervention and provide an audio recording of one group session.

Of the 9 participants in the online group, 5 were able to deliver the intervention and provide a recording of one group session. From the 12 therapists in the face-to-face group, 3 moved Trusts and were no longer able to participate, leaving 9 therapists, 7 of whom delivered the intervention and recorded one of their group sessions. All group sessions were delivered and recorded prior to the end of December 2013, allowing 6 months for the recruitment of patients and set up of the groups. In addition to the Heart of England NHS Foundation Trust, participants from the Royal Orthopaedic NHS Foundation Trust and Oxford University Hospitals NHS Trust did not deliver the BeST intervention. Reasons for not delivering the groups included difficulties identifying and finding eligible patients and a lack of time and space to set the groups up. Performance feedback was given to all participants who delivered the BeST group sessions following the assessment of their audio recording (total of 12 participants).

Figure 20. Flow of participants through RCT



6.2 Baseline data

The study recruited participants from 8 centres within or near to the Midlands area. These were: University Hospitals Coventry and Warwickshire NHS Trust (UHCW), South Warwickshire Foundation Hospital Trust (SWFT), Derby Hospitals NHS Foundation Trust, Heart of England NHS Foundation Trust (HOE), Oxford University Hospitals NHS Trust, the Royal Orthopaedic Hospital NHS Foundation Trust (ROH), Sandwell and West Birmingham Hospitals NHS Trust (SWB), and Worcestershire Acute Hospitals Trust. Participant characteristics from each site were similar for all baseline measures apart from age and years worked in their profession (shown in Table 15). Participants from HOE, ROH, SWB and Oxford were slightly younger and had worked in their profession for a mean of 6-7 years as opposed to a mean of 15-30.5 years at the other centres.

Participant characteristics from the randomised sample are detailed in Table 16. In summary, the majority of the participants were female (71.4%), aged between 26-45 years old (71.7%), and had worked in their profession for a mean of 12 years. Eighty per cent of the sample had received prior training in CBT, most of which was informal (60.9%), and nearly all participants had access to the internet daily (87.5%). Participants tended to identify a preference of face-to-face training (42.9%) over online training (17.1%), although forty per cent indicated that they had no prior training preference. Baseline characteristics and demographics were well balanced across both groups. Participants in the face-to-face training group had slightly higher PABS-PT factor one scores, with a group mean of 32.05 (SD 7.314) compared to 28.75 (SD 4.374) in the online training group. However, the range in the face-to-face group was large, with the highest score sitting 15 points above that in the online group, and the medium values (32 and 30) were very similar, suggesting the mean score may be skewed (76).

Table 15. Demographics and baseline characteristics by NHS centre

		UHCW	SWFT	Oxford	HOE	Derby	Worcester	ROH	SWB
N		**5**	**7**	**3**	**12**	**2**	**2**	**3**	**1**
Gender	Male, n. (%)	0	1 (14.3)	1 (33.3)	6 (50)	0	0	1 (33.3)	1 (100)
	Female, n. (%)	5 (100)	6 (85.7)	2 (66.7)	6 (50)	2 (100)	2 (100)	2 (66.7)	0
Age (years)	18-25, n (%)	1 (20)	0	0	2 (16.7)	0	0	0	0
	26-35, n (%)	2 (40)	3 (42.9)	2 (66.7)	7 (58.3)	0	0	3 (100)	1 (100)
	36-45, n (%)	1 (20)	2 (28.6)	1 (33.3)	3 (25)	2 (100)	0	0	0
	46-55, n (%)	0	1 (14.3)	0	0	0	2 (100)	0	0
	56-65, n (%)	1 (20)	1 (14.3)	0	0	0	0	0	0
Years worked in profession	M (SD)	15.9 (12.84)	16.07 (11.60)	6.67 (1.26)	7.17 (4.35)	16.5 (0.71)	30.5 (0.71)	7.17 (3.40)	6 (0)
	Median	10.5	15	6.5	6.5	16.5	30.5	6	6
	Range	33	28	3	16	1	1	7	0
Training in CBT	Yes, n (%)	3 (60)	7 (100)	1 (33.3)	9 (75)	2 (100)	2 (100)	3 (100)	1 (100)
	Formal, n (%)	1 (33.3)	3 (42.9)	1 (100)	3 (33.3)	1 (50)	0	1 (33.3)	1 (100)
	Informal, n (%)	2 (66.7)	4 (57.1)	0	6 (66.7)	1 (50)	2 (100)	2 (66.7)	0
	No, n (%)	2 (40)	0	2 (66.7)	3 (25)	0	0	0	0
Training preference	None, n (%)	4 (80)	2 (28.6)	1 (33.3)	5 (41.7)	1 (50)	0	1 (33.3)	0
	Online, n (%)	1 (20)	0	0	3 (25)	0	0	1 (33.3)	1 (100)
	Face to face, n (%)	0	5 (71.4)	2 (66.7)	4 (33.3)	1 (50)	2 (100)	1 (33.3)	0
Physiotherapy Attitudes and Beliefs Scale Factor 1 (*biomedical)*	M (SD)	29.8 (6.02)	33.14 (7.93)	29 (7)	29.17 (3.71)	34 (8.49)	26.5 (13.44)	35.67 (9)	23 (0)
	Median	30	30	26	30	34	26.5	38	23
	Range	16	24	13	12	12	19	9	0
Physiotherapy Attitudes and Beliefs Scale Factor 2 (*psychosocial)*	M (SD)	25.6 (3.65)	22.57 (2.88)	22.33 (2.52)	22.83 (2.98)	24 (2.83)	21.5 (6.36)	23.67 (2.52)	26 (0)
	Median	27	22	22	22	24	21.5	24	26
	Range	9	9	5	10	4	9	5	0

Table 16. Baseline characteristics of randomised participants by allocation

Category	Face-to-face n=19	Online n=16	Total n=35
Sex			
Male, n. (%)	7 (70)	3 (30)	10 (28.6)
Female, n. (%)	12 (48)	13 (52)	25 (71.4)
Age (years)			
18-25, n (%)	1 (33.3)	2 (66.7)	3 (8.6)
26-35, n (%)	11 (61.1)	7 (38.9)	18 (51.4)
36-45, n (%)	5 (55.6)	4 (44.4)	9 (25.7)
46-55, n (%)	1 (33.3)	2 (66.7)	3 (8.6)
56-65, n (%)	1 (50)	1 (50)	2 (5.7)
Years worked in profession			
No.	19	16	35
M (SD)	10.08 (8.045)	14.25 (10.872)	11.99 (9.532)
Median	7	10	8
Range	2-30	2-35	2-35
Training in CBT			
Yes, n (%)	16 (84.2)	12 (75.0)	28 (80.0)
Formal, n (%)	5 (31.3)	6 (50.0)	11 (39.3)
Informal, n (%)	11 (68.8)	6 (35.3)	17 (60.7)
No, n (%)	3 (15.8)	4 (25.0)	7 (20.0)
Access to a computer			
Daily, n (%)	18 (60)	12 (40)	30 (87.5)
2-3 times / week, n (%)	0 (0)	2 (100)	2 (5.7)
3-4 times / week, n (%)	0 (0)	2 (100)	2 (5.7)
4-5 times / week, n (%)	1 (100)	0 (0)	1 (2.9)
Location of access			
Work only, n (%)	7 (36.8)	6 (46.2)	13 (37.1)
Work and home, n (%)	12 (54.5)	10 (47.6)	22 (62.9)
Home only, n (%)	0 (0)	0 (0)	0 (0)
Training Preference			
None, n (%)	9 (64.3)	5 (31.7)	14 (40)
Online, n (%)	2 (33.3)	4 (66.7)	6 (17.1)
Face to face, n (%)	8 (53.3)	7 (46.7)	15 (42.9)
Physiotherapist attitudes and beliefs (PABS-PT) Factor 1			
No.	19	16	35
M (SD)	32.05 (7.314)	28.75 (4.374)	30.54 (6.289)
Median	32	30	30
Range	20-49	17-34	17-49
Physiotherapist attitudes and beliefs (PABS-PT) Factor 2			
No.	19	16	35
M (SD)	23.26 (3.347)	23.31 (2.869)	23.29 (3.092)
Median	22	23.5	23
Range	17-29	18-28	17-29

6.3 Numbers analysed

The analysis was intention to treat and included all participants who were randomly allocated. One participant in the online group and three from the face-to-face group withdrew from the study prior to commencing training. Therefore, data were available for 31 participants in the intention to treat analysis. Due to the high number of participants not delivering the BeST intervention, data were available from 12 participants for the analysis of the clinical competency.

6.4 Missing data and characteristics of the randomised sample

There were no differences in demographics or baseline characteristics between the participants that withdrew from the study and the remaining sample (Table 17).

Table 17. Baseline characteristics of withdrawals compared to remaining sample

Category	Withdrawals n=4	Completed n=31
Sex		
Male, n (%)	2 (50)	8 (25.8)
Female, n (%)	2 (50)	23 (74.2)
Age		
18-25, n (%)	0	3 (9.7)
26-35, n (%)	4 (100)	14 (45.2)
36-45, n (%)	0	9 (29)
46-55, n (%)	0	3 (9.7)
56-65, n (%)		2 (6.5)
Years worked in profession	0	
M (SD)	8 (3.34)	12.5 (9.97)
Median	9.5	8
Range	7	33
Training in CBT		
Yes, n (%)	2 (50)	5 (16.1)
Formal, (%)	2 (100)	15 (57.7)
Informal, n (%)	0	11 (42.3)
No, n (%)	2 (50)	28 (83.9)
Access to a computer		
Daily, n (%)	4 (100)	26 (86.7)
2-3 times / week, n (%)	0	2 (6.5)
3-4 times / week, n (%)	0	2 (6.5)
4-5 times / week, n (%)	0	1 (3.2)
Location of access		
Work only, n (%)	1 (25)	12 (38.7)
Work and home, n (%)	3 (75)	19 (61.3)
Home only, n (%)	0	0
Training preference		
None, n (%)	2 (50)	12 (38.7)
Online, n (%)	0	6 (19.4)
Face to face, n (%)	2 (50)	13 (41.9)
Physiotherapist attitudes and beliefs (PABS-PT) Factor 1		
M (SD)	27.5 (3.7)	30.94 (6.49)
Median	29.00	30
Range	8	32
Physiotherapist attitudes and beliefs (PABS-PT) Factor 2		
M (SD)	24 (3.74)	23.19 (3.06)
Median	23.50	22
Range	9.00	12

6.5 Outcome Measures

This section presents the descriptive statistics for continuous outcome measures, followed by estimated group differences, and then provides a narrative description for each outcome measure to accompany the data presented in the tables. Statistical analyses of categorical outcomes are subsequently presented before offering additional exploratory analyses.

6.5.1 Descriptive statistics for continuous outcomes

Descriptive statistics are presented in Table 18. The nominal outcome measure, satisfaction, was converted to scale data (1 very unsatisfied to 5 very satisfied) for ease of comparison.

Table 18. Summary statistics for all continuous outcome measures

Statistics		Face to Face	Online
Physiotherapist attitudes and beliefs (PABS-PT) Factor 1 (*biomedical attitudes and beliefs)*	N	16	14
	Mean	25.13	27.71
	Std. Deviation	6.84	5.33
	Median	24.00	27.00
	Range	23.00	18.00
Physiotherapist attitudes and beliefs (PABS-PT) Factor 2 *(psychosocial attitudes and beliefs)*	N	16	14
	Mean	25.94	22.71
	Std. Deviation	4.22	5.14
	Median	26.50	22.00
	Range	16.00	16.00
CTS-R-Pain	N	7	5
	Mean	2.08	1.90
	Std. Deviation	0.33	0.18
	Median	1.93	1.93
	Range	0.86	0.46
knowledge test	N	16	15
	Mean	25.53	26.50
	Std. Deviation	3.27	2.96
	Median	25.75	27.00
	Range	10.50	10.50
Self-efficacy: Assessment	N	16	15
	Mean	7.38	5.65
	Std. Deviation	1.58	1.95
	Median	7.90	5.50
	Range	5.30	8.20
Self-efficacy: Group session	N	16	15
	Mean	6.45	6.20
	Std. Deviation	2.50	1.75
	Median	7.20	6.50
	Range	8.60	7.20
Satisfaction	N	16	15
	Mean	4.69	3.73
	Std. Deviation	0.48	0.70
	Median	5	4
	Range	1	3

Descriptive statistics are also presented for the individual item scores of the CTS-R-Pain competency assessment tool, show in Table 19.

Table 19. Mean CTS-R item scores per group

Item	Skill	Statistics	Face to face	Online
1	**Agenda setting and adherence**	Mean (SD)	1.86 (1.22)	1.4 (0.89)
		Median	2.0	2.0
		N	7	5
2	**Feedback**	Mean (SD)	1.71 (0.49)	1.4 (0.89)
		Median	2.0	1.0
		N	7	5
3	**Collaboration**	Mean (SD)	2.57 (0.54)	2.6 (0.55)
		Median	3.0	3.0
		N	7	5
4	**Pacing and efficient use of time**	Mean (SD)	2.57 (0.54)	2.6 (0.55)
		Median	3.0	3.0
		N	7	5
5	**Interpersonal effectiveness**	Mean (SD)	2.71 (0.76)	2.6 (0.55)
		Median	3.0	3.0
		N	7	5
6	**Eliciting appropriate emotional expression**	Mean (SD)	2.29 (0.49)	1.6 (0.55)
		Median	2.0	2.0
		N	7	5
7	**Eliciting key pain relevant cognitions**	Mean (SD)	1.71 (0.95)	1.6 (1.14)
		Median	1.0	2.0
		N	7	5
8	**Eliciting pain management behaviours**	Mean (SD)	2.57 (0.79)	2 (0)
		Median	2.0	2.0
		N	7	5
9	**Guided discovery**	Mean (SD)	1.14 (0.69)	1.4 (0.55)
		Median	1.0	1.0
		N	7	5
10	**CB conceptionalisation of patients pain related disability and distress**	Mean (SD)	2.57 (0.79)	1.6 (0.89)
		Median	2.0	1.0
		N	7	5
11	**Application of change methods***	Mean (SD)	1.67 (0.82)	1.75 (0.5)
		Median	1.5	2.0
		N	6	4
12	**Homework setting#**	Mean (SD)	1.83 (0.75)	2.8 (0.84)
		Median	2.0	3.0
		N	6	5
13	**Facilitating behavioural change***	Mean (SD)	2.33 (0.82)	2 (0)
		Median	2.5	2.0
		N	6	4
14	**Supporting change**	Mean (SD)	1.29 (0.95)	1.6 (0.89)
		Median	1.0	1.0
		N	7	5
15	**Recognition of professional boundaries^**	Mean (SD)	2.00 (0.71)	1 (n/a)
		Median	2.0	1.0
		N	1	1

**This item was not scored for therapists delivering group session one.*

#This item was not scored for therapists delivering group session six.

^This item was only scored if it arose during the session.

6.5.2 Estimated group differences for continuous outcomes

Estimated differences between group means for continuous outcome measures with 95% confidence intervals (CIs) are illustrated in Table 20. SMDs are presented to further aid comparison between the two groups. For outcomes recorded at baseline and follow-up (PABS-PT factors one and two), the mean change in score from baseline to follow-up is reported. As per chapter 5, section 5.11, where applicable, results were adjusted for baseline values of the variable being tested.

Table 20. Mean difference in outcome measures between both groups

Outcome measure	N	Face to face mean (SD)	Online mean (SD)	Mean difference (95% CI)	P-value	Effect size (95% CI)
CTS-R Pain	12	2.08 (0.33)	1.90 (0.18)	0.17 (-0.2; 0.54)	0.32	-0.68 (-1.86, 0.51)
Knowledge	31	25.53 (3.27)	26.5 (2.96)	0.97 (-1.33; 3.26)	0.4	0.31 (-0.4; 1.02)
Change in PABS-PT Factor 1 *(biomedical attitudes and beliefs)* [+]	30	-8.1 (4.07)	-0.67 (4.87)	-7.43 (-10.97; -3.89)	<0.01	-1.66 (-2.46, -0.85)
Change in PABS-PT Factor 2 *(psychosocial attitudes and beliefs)* [+]	30	2.83 (5.67)	-0.52 (3.52)	3.35 (-0.19; 6.89)	0.06	-0.71 (-1.44, 0.02)
Self-efficacy: Assessment	31	7.38 (1.58)	5.65 (1.95)	1.73 (0.43; 3.03)	0.01	-0.97 (-1.71, -0.24)
Self-efficacy: Group session	31	6.45 (2.50)	6.3 (1.75)	0.25 (-1.7; 0.7)	0.34*	-0.07 (-0.77, 0.64)
Satisfaction	31	4.69 (0.48)	3.73 (0.70)	0.95 (0.52; 1.39)	<0.01	-1.60 (-2.38, -0.81)

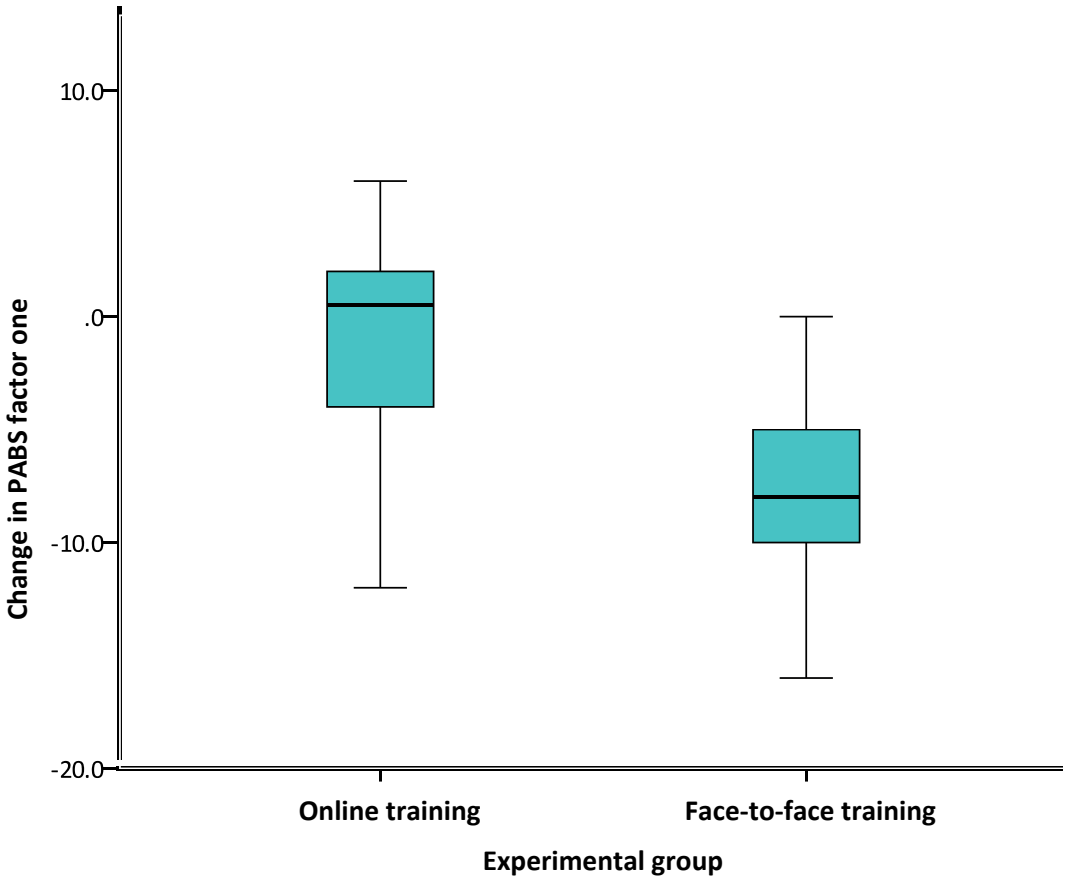
[+]*Adjusted for baseline PABS F1 and F2 scores respectively.*
**Data did not meet assumptions of t-test; therefore Mann-Whitney U was used.*

6.5.3 Narrative description of continuous outcomes

PABS-PT (physiotherapist attitudes and beliefs towards the management of chronic LBP patients)

Participants in the face to face training group showed a greater reduction in their mean PABS-PT factor one score (biomedical attitudes and beliefs to managing chronic LBP), with the confidence interval around the mean difference suggesting that the smallest difference between the two groups was -3.89 points in favour of the face-to-face group. The actual difference between the two groups may have been larger, with the upper end of the confidence interval suggesting that the difference could be as much as -10.97 points (illustrated in Figure 20). As well as showing a greater decrease in their biomedical attitudes and beliefs, the face-to-face group also showed an increase in their psychosocial attitudes and beliefs, with a group mean 3.31 points higher than the online group. However, the difference in the mean change for PABS-PT factor two was not statistically significant (p=0.07; 95% CI: -0.19; 6.89). Looking at the change in PABS-PT factors one and two, online training appears to have exerted little influence over the attitudes and beliefs of participants for either factor with mean change scores of -0.67 (SD 4.87) and -0.52 (SD 3.52) respectively.

Figure 21. Boxplot showing the adjusted mean change in PABS-PT factor one in both groups



CTS-R-Pain (clinical competency)

Due to the low rate of implementation of the BeST intervention, the sample providing data to assess clinical competency was small. Individual competency scores were similar and low in both groups, ranging from 1.22 to 2.94 in the face-to-face group and 1.44 to 2.36 in the online group. According to the scoring framework presented in chapter 5, section 5.7.2, the clinical competency of participants in both groups was at either a novice or advanced beginner status (scoring either 1-2 or 2-3 of 6 points respectively). The confidence interval around the mean difference in group competency score suggests that the mean difference between both groups lay somewhere between -0.3 points (favours online) to 0.54 points (favours face-to-face).

Table 19 shows that the individual CTS-R-Pain item scores for both groups were also low. On the whole, both groups appeared to score least for agenda setting (item 1), giving and

eliciting feedback (item 2), eliciting and challenging pain relevant cognitions (items 7 and 11), supporting change outside of the BeST intervention (item 14), and using guided discovery (item 9). Participants were better at collaboration (item 3), pacing and efficient use of time (item 4), interpersonal effectiveness (item 5), and facilitating behavioural change (item 13).

Self-efficacy

Participants in the face-to-face group reported greater confidence to carry out the BeST assessment with patients. The mean difference between groups was statistically significant (p=0.01; 95% CI: 0.43; 3.03). Both groups recorded a similar group mean score concerning their self-efficacy to deliver the BeST group sessions.

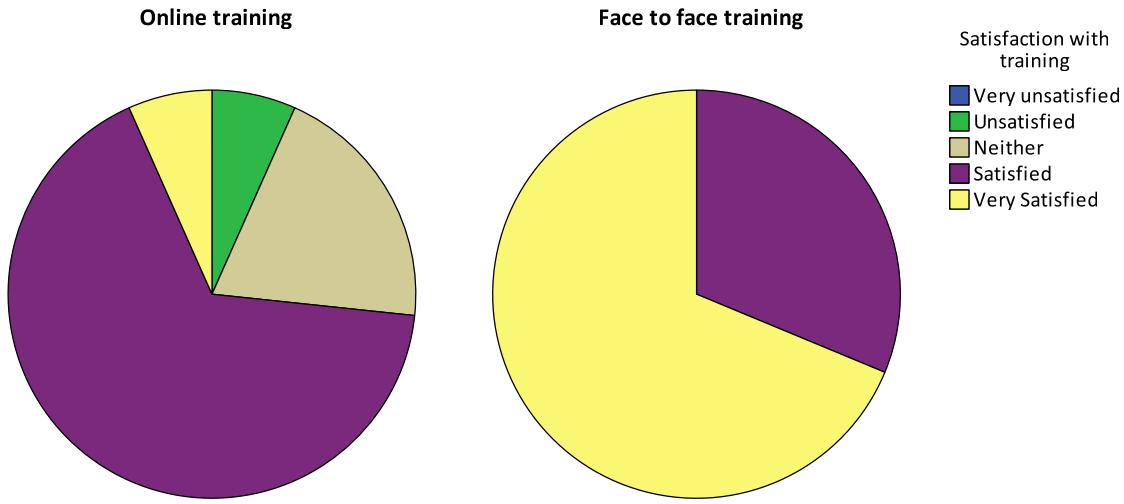
Knowledge

Both groups scored highly on the knowledge test. The face-to-face group achieved a mean score of 25.52 (SD 3.27), equating to 82% of the total score, while the online group mean was 26.5 (SD 2.96) reflecting 85% of the total score. The confidence interval around the mean difference crosses zero and thus, the two groups in this sample may not have differed on their mean knowledge scores. However, the confidence interval is not very precise and suggests that the actual difference could favour the face-to-face group by -1.33 points, or favour the online group by 3.26 points.

Satisfaction

The face-to-face group were significantly more satisfied with the training (p=<0.01; 95% CI: 0.52; 1.39), with the confidence interval of the mean difference suggesting that the smallest difference between the two groups was 0.52 points in favour of the face-to-face group. Eleven of nineteen participants reported that they were very satisfied with the training in the face-to-face group. From the online group, 11 participants were satisfied with the training, 3 were neither satisfied nor dissatisfied and 1 was unsatisfied. The pie charts in Figure 21 illustrate satisfaction ratings across both groups.

Figure 22. Pie charts illustrating participant satisfaction across both groups



6.5.4 Descriptive statistics and estimated group difference for categorical outcomes

Implementation of the BeST intervention

Less than half of all participants implemented the BeST intervention: 43% of face-to-face participants and 33% of online participants (Table 21). The difference in implementation between the two groups was not statistically significant (p=0.411; Table 22).

Table 21. Descriptive statistics and estimated group difference for the implementation of the BeST intervention

Allocation	Delivering BeST		Total	Frequency (%)	Pearson Chi-Squared	p-value
	No	Yes				
Face-to-face	9	7	16	43.8	0.354	P=0.411
Online	10	5	15	33.3		
Total	19	12	31	38.7		

6.6 Additional analyses

6.6.1 Exploration of participant preference

As specified in the study protocol, results from the outcome measures were stratified according to participants' prior training preference, shown in Table 22. For each outcome the highest scoring category is shaded in blue. To aid this exploration into the influence of

preference on study outcomes, the data was classified by: those receiving their preference or with no prior preference, and those not receiving their preference.

Table 22. Investigating the results of participants that either received their preference or had no preference compared to those allocated against their preference

Stratification			Knowledge[#]	Satisfaction[#]	Self efficacy Assessment[#]	Self efficacy Group[#]	Change in PABS-PT Factor One*	Change in PABS-PT Factor Two[+]	CTS-R Pain[#]
Online training	Allocated to preference or no preference	Mean	25.31	3.75	5.48	5.74	-0.75	-0.75	2.03
		N	8	8	8	8	8	8	2
		SD	3.23	0.46	2.13	2.00	5.28	3.88	0.14
	Not allocated to preference	Mean	27.86	3.71	5.86	6.73	-1.00	-0.17	1.82
		N	7	7	7	7	6	6	3
		SD	2.06	0.95	1.87	1.37	4.73	3.31	0.17
Face-to-face training	Allocated to preference or no preference	Mean	25.14	4.71	7.39	6.26	-8.29	2.86	2.12
		N	14	14	14	14	14	14	6
		SD	3.20	0.47	1.67	2.60	4.21	5.93	0.34
	Not allocated to preference	Mean	28.25	4.50	7.35	7.75	-5.50	2.50	1.79
		N	2	2	2	2	2	2	1
		SD	3.18	0.71	1.06	1.34	2.12	4.95	0

**Desired result is a negative change, a decrease in score.*

[+]*Desired result is a positive change, an increase in score.*

[#]*Higher scores denote better outcomes*

= most desirable score

Table 22 indicates that those allocated to their preference or with no preference were the most satisfied in both training arms. It also shows that, for both groups, those allocated against their preference scored higher in the post training knowledge test.

6.7 Exploration behind the low implementation rate

6.7.1 Characteristics of those delivering groups versus those not

Given the high proportion of participants that did not deliver the BeST intervention, it was important to investigate whether the participants delivering the group sessions differed in any way to those that did not. Table 23 shows the baseline characteristics according to those delivering the group sessions versus those not delivering the groups.

Table 23. Baseline characteristics of participants delivering groups versus those not

Characteristic	Delivering group	
	No	**Yes**
	n = 23	**n = 12**
Age		
18-25 years, n (%)	3 (13)	0
26-35 years, n (%)	14 (60.9)	4 (33.3)
36-45 years, n (%)	6 (26.1)	3 (25)
46-55 years, n (%)	0	3 (25)
56-65 years, n (%)	0	2 (16.7)
Sex		
Male, n (%)	9 (39.1)	1 (8.3)
Female, n (%)	14 (60.9)	11 (91.7)
Years worked in profession		
M (SD)	7.76 (4.92)	20.08 (11.12)
Median	6.5	19.5
Range	19	29
Training in CBT		
Yes, n (%)	17 (73.9)	11 (91.7)
Formal, n (%)	6 (35.3)	5 (45.5)
Informal, n (%)	11 (64.7)	6 (54.5)
No, n (%)	6 (26.1)	1 (8.3)
Training Preference		
None, n (%)	10 (43.5)	4 (33.3)
Online, n (%)	4 (17.4)	2 (16.7)
Face to face, n (%)	9 (39.1)	6 (50)
PABS-PT Factor One *(biomedical attitudes and beliefs)*		
M (SD)	30.52 (4.5)	30.58 (9.04)
Median	30	29.5
Range	17	32
PABS-PT Factor Two *(psychosocial attitudes and beliefs)*		
M (SD)	22.96 (2.64)	23.92 (3.87)
Median	22	23
Range	10	12

Looking at the baseline characteristics in Table 23, participants delivering the group sessions had worked for longer in their profession, tended to be older, and female. A fishers exact test showed that the difference in participant age was statistically significant (p=0.013), however, no single category was statistically significant on its own. The number

of years worked in profession was not normally distributed, therefore a Mann-Whitney U test showed that the difference between the two groups was statistically significant (p=0.001; 95% CI: -22.0; -4.0). The difference in sex between the two groups was not statistically significant (p=0.113).

Table 24 stratifies the results from the outcome measures according to those delivering groups versus those not. Whilst there were no statistically significant differences between the two groups, participants delivering the groups reported greater self-efficacy to conduct the BeST assessment and group sessions, showed a greater reduction in biomedical attitudes and beliefs (PABS-PT factor one) and a greater increase in psychosocial attitudes and beliefs (PABS-PT factor two), scored higher on the post-training knowledge test, and reported slightly greater satisfaction with the training.

Table 24. Outcome measures stratified by participants delivering groups versus those not

Outcome measure	Statistics	Delivering group		Mean difference (95% CI)	p-value
		No	Yes		
PABS-PT F1 ***(biomedical attitudes and beliefs)***	N	18	12	2.08 (-2.69; 6.85)	0.378
	M (SD)	27.17 (4.72)	25.08 (8.04)		
	Median	26.5	25.00		
	Range	16	23		
Change in PABS-PT F1[+]	M (SD)	-4.12 (5.15)	-5.4 (6.50)	-1.28 (-5.82; 3.25)	0.504
	Median	-4.000	-7.000		
	Range	19.0	20.0		
PABS-PT F2 ***(psychosocial attitudes and beliefs)***	N	18	12	3.44 (-6.98; 0.1)	0.056
	M (SD)	23.06 (4.67)	26.5 (4.6)		
	Median	24.50	27.50		
	Range	16	14		
Change in PABS-PT F2[+]	M (SD)	0.63 (5.20)	2.22 (4.58)	1.59 (-2.17; 5.36)	0.246
	Median	1.500	2.000		
	Range	22.0	18.0		
SE assessment	N	19	12	0.4 (-1.89; 1.08)	0.584
	M (SD)	6.39 (1.97)	6.79 (1.97)		
	Median	6.100	6.550		
	Range	7.6	5.7		
SE group	N	19	12	0.06 (-1.70; 1.58)	0.939
	M (SD)	6.31 (2.23)	6.37 (2.08)		
	Median	6.600	6.850		
	Range	8.4	7.3		
Knowledge	N	19	12	0.34 (-2.72; 2.04)	0.772
	M (SD)	25.87 (3.51)	26.21 (2.47)		
	Median	27.000	26.250		
	Range	11.0	9.0		
Satisfaction	N	19	12	0.04 (-0.62; 0.55)	0.891
	M (SD)	4.21 (0.86)	4.25 (0.62)		
	Median	4.00	4.00		
	Range	3	2		

[+]*Adjusted for baseline PABS-PT F1 and F2 scores respectively.*

Chapter 6a - Learner Analytics

Learner analytics provided information regarding participants' online behaviour within i-BeST. This chapter details the methods used to obtain three measures of online behaviour from the detailed analytics data and reports how these measures were used to create a final depiction of participant engagement with i-BeST. Results from the online participants in the RCT are then explored according their degree of engagement with the online course.

6a.1 Methods

Stage One – Calculating the time spent learning

Once a participant had completed their post-training knowledge test, signifying course completion, the learner analytics for that participant were downloaded into Microsoft Excel in the format illustrated in Table 25.

Table 25. The format of learner analytics in Microsoft Excel

ID	Module	Current slide	Next slide	Date (dd/mm/yy)	Time (hh:mm:ss)	Time per slide (hh:mm:ss)
i-BeST00	Session One	3	4	15/05/2013	15:01:20	-
i-BeST00	Session One	4	5	15/05/2013	15:01:40	00:00:20

The example above shows that the participant moved onto slide 4 in session one at 15:01:20 hours and spent 20 seconds on the slide before moving onto slide 5 in session one at 15:01:40 hours. In order to calculate the length of time the participant spent on each slide, an additional 'time per slide' column was created. In this new column, each time stamp was subtracted from the previous cell to obtain the time difference between the values of each corresponding cell. Therefore, this new column contained the length of time that the participant spent on each slide. At this point, data cleaning was required to extract the time spent outside of the modules. This was identified though double slide entries (anomalies where the current and next slide cells contained the same values) in the analytics, signifying that the user had exited and either re-entered or started a new

module. These times were extracted from the 'time spent per module' column, replacing the value with a '00:00:00' time entry and placed into a further column titled 'time spent outside of modules'. The mini-tests following sessions 1-6, along with other features within the Moodle site, such as the forum, would be captured in this 'between module time'.

Following this, the time per slide column values, along with the current slide column, were extracted into a separate worksheet for each module. The data were then sorted and summed according to the slide number, giving the total time spent per slide over the whole duration of their training, and the total length of time taken to complete the whole module. This was repeated for each participant and by the end of this process the following information was obtained:

- Total time spent within the i-BeST course.
- Total time spent between course modules.
- Total time spent within each module.
- Total time spent per slide within each module.
- Average time per slide within each module.

Stage two – calculating the degree of course completion

For each module, the total number of slides was established and recorded in a frequency table. The analytics were then checked for each participant to establish if they accessed every slide within these modules. If they did not, a record was kept to note which slides were missed to enable the identification of any emerging patterns. From this table the following information was available:

- The number and percentage of slides accessed within each of the modules.
- The total number and percentage of all slides accessed.
- A record of what slides were not visited and by whom.

Stage three – calculating the degree of interaction with the course

The learner analytics also reported what links or downloads a participant used. This was evident in the learner analytics data when the current and next slide columns held a value of -1. In an additional column, a link would also be present, indicating what resource was accessed. A frequency table was used to record the number of links and resources that were accessed by each participant.

Stage four – creating a measure of engagement

Despite the recent attention given to learner analytics for the evaluation of online learning (157, 158), there is little research or guidance in the literature to determine which detectable aspects of a course are pedagogically meaningful or reflective of participation in purposeful activity (159). Considering the learning objectives of the i-BeST course, the following pragmatic decisions were made to create a measure of participant engagement:

- Engagement was measured in relation to the 10 core modules of the course (detailed in chapter 3 and illustrated in figure 10), since these modules provided all the necessary training to deliver the BeST intervention.
- The three quantifiable variables detailed above (access to core module slides, time spent within core modules and interaction with core module resources) would be used to create this measure of engagement using the methods detailed below.

For each of the three variables, the 33rd and 66th percentiles were found. Participants in the lower percentile were then awarded a score of 1 for that measure; a score of 2 was given to participants in the middle third and a score of 3 was allocated to those in the upper third. The scores for each of the three measures were then averaged to give each participant an overall score of engagement. Participants with a mean score in the top 66th percentile were categorised as having 'higher engagement' and those in the lower percentiles categorised as having 'lower engagement'.

6a.2 Results

6a.2.1 Course completion

Table 26 shows the extent to which each participant accessed the core modules of the course. On the whole, compliance was high, with over half of all participants accessing every slide in the 10 core modules and 11 of 16 participants accessing over 90% of all slides. Three participants accessed less than 50% of each core module.

Table 26. Number of slides accessed per participant for all core modules

ID	No of slides visited										
	Introduction (total 4)	Background (total 17)	Clinical skills (total 13)	Assessment (total 4)	Session 1 (total 30)	Session 2 (total 24)	Session 3 (total 26)	Session 4 (total 12)	Session 5 (total 7)	Session 6 (total 4)	Total (141)
239	0	0	0	0	0	0	0	0	0	0	0
366	4	0	13	0	0	0	0	0	0	0	17
288	4	17	13	4	30	24	26	12	7	4	141
209	4	17	13	4	30	24	26	12	7	4	141
232	4	17	13	4	30	24	26	12	7	4	141
276	4	17	13	4	30	24	0	0	0	0	92
281	4	17	13	4	1	15	26	4	1	0	85
208	4	17	13	4	19	19	25	12	7	4	124
289	4	17	13	4	30	24	26	12	7	4	141
243	4	17	13	4	30	24	26	12	7	4	141
258	4	17	13	4	30	24	26	12	7	4	141
337	4	17	13	4	24	24	20	12	7	4	129
197	4	17	13	4	30	24	26	12	7	4	141
257	4	16	13	4	30	24	26	12	7	4	140
350	4	17	12	4	30	22	21	11	7	4	132
226	4	17	13	4	30	24	26	12	7	4	141

100% complete

Withdrawn

Completed ≤50% of the module

Not fully completed

6a.2.2 Time spent online

Whilst participants may have accessed each slide, this provides little information as to whether they read the slide contents. Figure 22 illustrates the mean time that all participants spent within the course modules, between the course modules, and the total mean time spent within and between course modules. Figure 23 shows these times per individual participant.

Figure 23. Mean time spent online within and between course modules for all participants

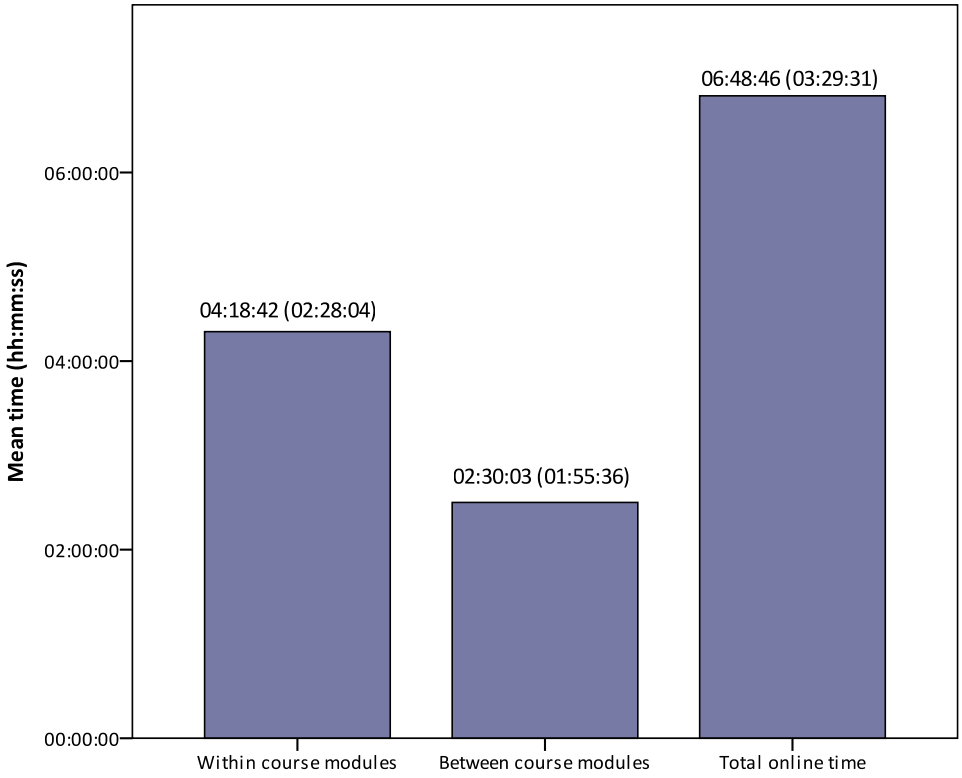
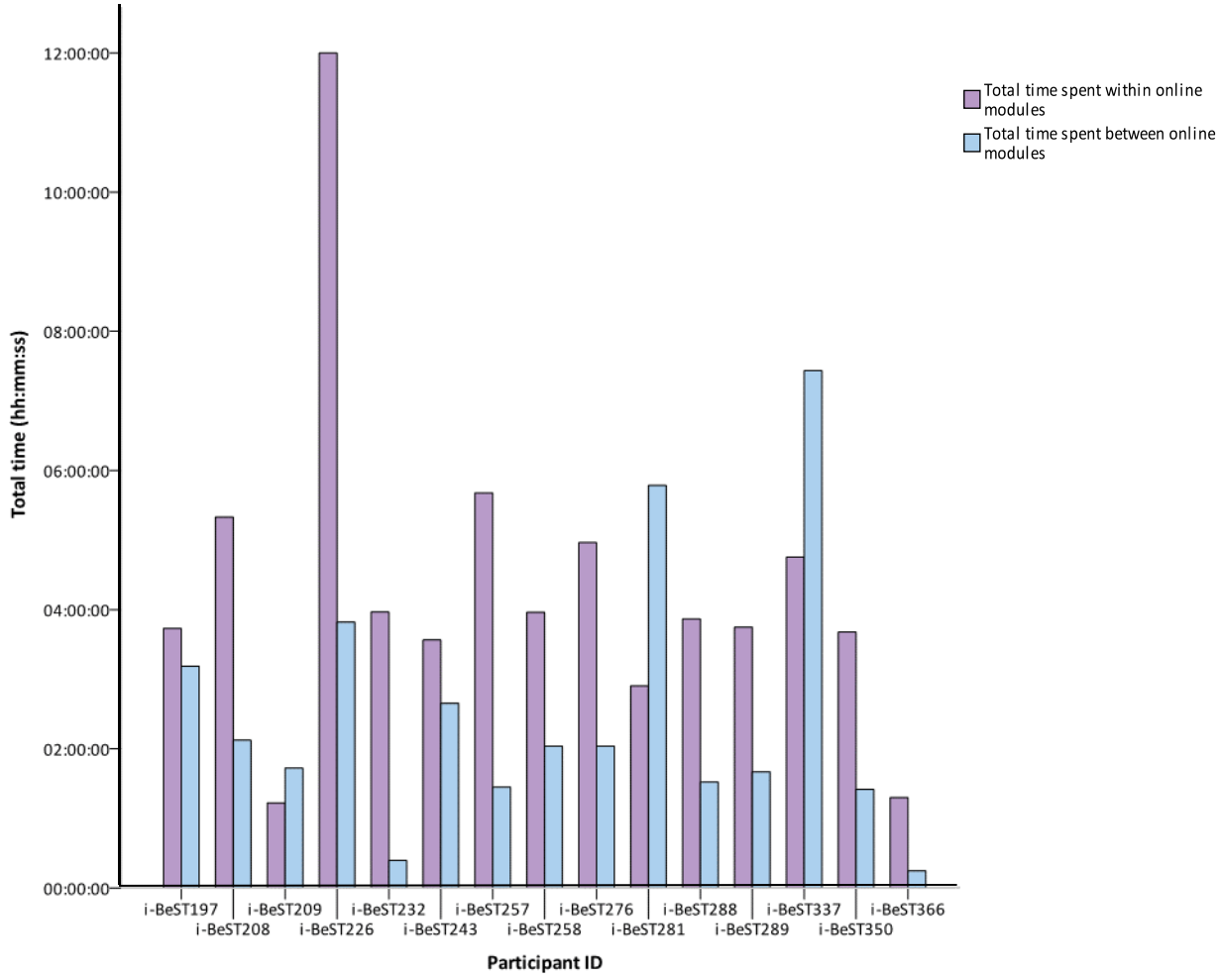


Figure 24. Mean time spent online within and between course modules per participant



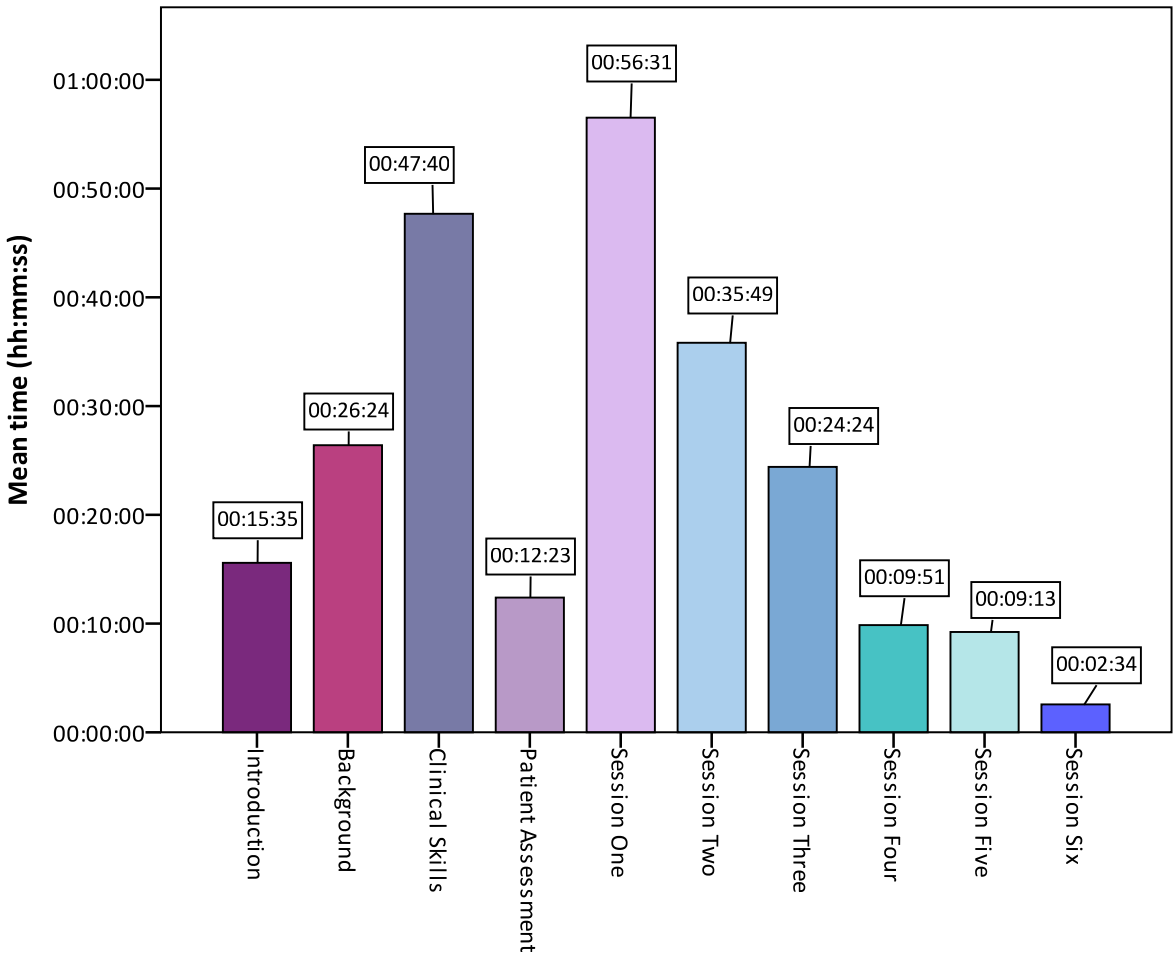
The total mean time spent using the online course was 6:48:46, with the shortest duration at 1:32:55 and the longest duration at 15:49:17. The mean time that participants spent within the course modules was 4:18:42 (range 1:13:24 to 11:59:58). The time spent between modules (Figures 21 and 22) was not small for the majority of participants, and is not in itself very useful since any inferences as to whether the recorded between module time was spent using other parts of the site is largely speculative.

Table 27 and Figure 24 show the mean time spent within each core module for all participants.

Table 27. Total mean time of all participants spent within each core module

Module	N	Time (hh:mm:ss)		
		Range	Mean	SD
Introduction	15	1:19:30	0:15:35	0:20:56
Background	15	1:16:21	0:26:24	0:22:15
Clinical Skills	15	1:25:27	0:47:40	0:21:34
Assessment	15	0:44:25	0:12:23	0:10:47
Session One	15	3:58:39	0:56:31	0:58:24
Session Two	15	3:28:27	0:35:49	0:49:52
Session Three	15	1:59:26	0:24:24	0:29:52
Session Four	15	0:28:46	0:09:51	0:08:02
Session Five	15	0:31:48	0:09:13	0:08:16
Session Six	15	0:11:21	0:02:34	0:02:58

Figure 25. Mean time spent on core modules for all participants



The bar chart in Figure 24 shows the average time to complete the modules gradually declining as the participants worked through the course. Session 1 contained the most slides (30) and also took the longest to complete, with participants spending a mean time of 59 minutes on it. However, an association between length of the module and the time taken to complete it is not consistent. The clinical skills module contained only 13 slides and yet took a mean time of 48 minutes to complete compared to, for example, a mean time of 24 minutes for session 3, which contained 26 slides. Table 28 shows the average time spent per slide within each module.

Table 28. Mean time per slide in each core module for all participants

Module	Mean time	Slides	Mean time per slide
Introduction	0:15:35	4	00:03:54
Background	0:26:24	17	00:01:33
Clinical Skills	0:47:40	13	00:03:40
Assessment	0:12:23	4	00:03:06
Session 1	0:56:31	30	00:01:53
Session 2	0:35:49	24	00:01:30
Session 3	0:24:24	26	00:00:56
Session 4	0:09:51	12	00:00:49
Session 5	0:09:13	7	00:01:19
Session 6	0:02:34	4	00:00:39

When considering the average number of words per slide against the average adult reading speed, Table 28 suggests that on participants spent longer than was necessary on each slide. Each slide contained an average of 100 words, while the average reading speed for adults educated to a college level or higher is 300 words per minute (160). This would

suggest that participants could work through 3 slides per minute, spending an average of 20 seconds on each slide. However, the literature does suggest that reading from a computer screen may be up to 20-30% slower than reading from paper materials (161). Taking this into account, the average times per slide recorded in Table 28 still suggest that participants spent an adequate amount of time on each slide to read the contents.

The recorded times in Table 28 indicate that participants spent longer on slides in the Introduction, Clinical Skills and Assessment modules. This variation in the time spent per slide could be explained the number of video links and downloadable materials available within that session, explored in the next section.

6b.2.3 Interaction with links and downloadable materials

Table 29 shows the list of video links and downloadable materials that participants were asked to access during each session, along with the number of participants that actually opened the material.

Table 29. A list of available links and downloadable material for each module

Module	Available download/video link	Degree of access n (%)
		N=15
Introduction	Paper 1 (Lamb et al, 2010)	14 (93)
	Paper 2 (Hansen et al, 2010)	13 (86)
Background	Paper 1 (Grazebrook et al, 2005)	14 (93)
Clinical skills	Download 1 (guided discovery)	12 (80)
	Download 2 (text for last video)	14 (93)
	Video 1 (questioning example)	13 (86)
	Video 2 (subjective history)	13 (86)
	Video 3 (guided discovery)	10 (66)
Assessment	Download 1 (guidelines)	14 (93)
	Download 2 (form)	13 (86)
Session 1	Download 1 (narrative)	12 (80)
	Download 2 (crib sheet)	13 (86)
	Download 3 (nervous system)	12 (73)
	Video 1 (pain memory)	8 (53)
	Video 2 (explain pain)	11 (73)
	Video 3 (S1 demo)	11 (73)
Session 2	Download 1 (narrative)	13 (86)
	Download 2 (crib sheet)	9 (60)
Session 3	Download 1 (narrative)	12 (80)
	Download 2 (crib sheet)	9 (60)
	Download 3 (thought validation)	6 (40)
	Video 1 (S3 demo)	11 (73)
Session 4	Download 1 (narrative)	11 (73)
	Download 2 (crib sheet)	7 (46)
Session 5	Download 1 (narrative)	12 (80)
	Download 2 (crib sheet)	8 (53)
Session 6	Download 1 (narrative)	10 (66)
	Download 2 (crib sheet)	4 (26)
Hints and tips	Download 1 (skills rating)	3 (20)
Resources	Download 1 (references)	2 (13)
	Download 2 (resources)	2 (13)

Table 29 shows that session 1, session 3 and the clinical skills module had the highest number of links/downloadable material. It also highlights that none of the links or

downloads were accessed by all participants, with many accessed by less than half of them. Additionally, the table shows a pattern of declining access with progression through the course, with the narrative and crib sheet in Session 6 the least accessed of all session narratives. Two of three research papers, one provided in the introduction and the other in the Background section, were the most highly accessed materials.

Interaction with the course outside of the core modules

As detailed in the methods section of this chapter, whilst the time that participants spent between the core modules was recorded, the analytics could not provide information regarding what participants did in this time. Using data captured from Moodle itself, Table 30 shows which participants accessed aspects of the website outside of the core modules.

Table 30. Access to aspects of the course in Moodle outside of the core modules

	Aspects of the course outside of the core modules					
ID	**Tutorial 1**	**Tutorial 2**	**Forum**	**Resources**	**Mini-tests**	**Meet the Team**
337	Yes	Yes	Yes (once)	Yes	6	Yes
258	Yes	Yes	Yes (once)	Yes	6	Yes
350	Yes	No	No	Yes	5	Yes
232	Yes	No	No	No	6	No
289	Yes	Yes	No	Yes	6	No
226	Yes	No	No	No	6	Yes
243	Yes	No	Yes (once)	Yes	6	Yes
208	Yes	Yes	Yes (once)	Yes	6	Yes
257	Yes	Yes	No	No	5	Yes
197	Yes	No	No	No	6	No
288	Yes	No	No	Yes	6	No
209	Yes	No	No	No	5	No
281	Yes	Yes	No	Yes	0	Yes
366	Yes	Yes	Yes (once)	No	6	Yes
276	Yes	No	No	No	1	Yes
Total	**100%**	**46%**	**33%**	**53%**	**67%**	**67%**

All participants accessed the first tutorial and just under half accessed the second. Only 33% of participants accessed the forum and of those that did, they accessed it only once. Ten participants accessed the 'meet the team' section, spending a mean time of 0:01:09

there. Two thirds of the participants completed all of the mini-tests. Studying the raw learner analytics data, only two participants re-visited a module following its mini-test, as recommended in the feedback that was provided for any wrong answer. Since no participants scored 100% in any of the mini-tests, they would have all received feedback prompting them to re-visit the relevant parts of the course. All participants completed the modules in the suggested order. Nine of fifteen participants re-visited the site at later dates, often on numerous occasions.

6a.2.4 Degree of engagement with the online course

Participants were allocated an overall score of engagement using three online behaviour measures obtained from the analytics, as detailed in the methods section of this chapter. Tables 31, 32 and 33 show the participants stratified according to their online behaviour for these three measures.

Table 31. Classification of engagement through access to core module slides

Slides access (n=137)	ID	Score	Number accessed
66th percentile (141 slides)	**288**	3	141
	209	3	141
	232	3	141
	289	3	141
	243	3	141
	258	3	141
	197	3	141
	226	3	141
Middle percentile	**257**	2	140
	350	2	132
33rd percentile (130 slides)	**366**	1	17
	276	1	92
	281	1	85
	208	1	124
	337	1	129

Table 32. Classification of engagement through time spent within the core modules

Length of time spent within core modules	ID	Score	Time (hh:mm:ss)
Above 66th percentile (04:29:33)	208	3	05:19:51
	337	3	04:45:20
	276	3	04:57:51
	226	3	11:59:58
	257	3	05:40:41
Middle percentile	258	2	03:57:46
	289	2	03:44:59
	232	2	03:58:00
	288	2	03:52:01
	197	2	03:43:52
Below 33rd percentile (03:41:45)	281	1	02:54:18
	350	1	03:40:42
	366	1	01:18:00
	243	1	03:33:51
	209	1	01:13:24

Table 33. Classification of engagement through interaction with downloads and links in core modules

Degree of access with downloads/links	ID	Score	Number accessed
66th percentile (24 of 28)	337	3	25
	258	3	28
	350	3	26
	226	3	27
	243	3	27
Middle percentile (20-23 of 28)	289	2	22
	208	2	20
	257	2	21
	197	2	22
	288	2	22
33rd percentile (19 of 28)	232	1	19
	209	1	14
	366	1	3
	276	1	18
	281	1	15

Table 34 shows the overall score of engagement per participant based on the three measures detailed above. The value for the 66th percentile was an overall score of 2.33 or more. This stratified the participants into only two groups due to the proximity of the scores.

Table 34. Mean score of engagement for each online participant

ID	Interaction	Time	Access	Mean
366	1	1	1	1.00
288	2	2	3	2.33
209	1	1	3	1.67
232	1	2	3	2.00
276	1	3	1	1.67
281	1	1	1	1.00
208	2	3	1	2.00
289	2	2	3	2.33
243	3	1	3	2.33
258	3	2	3	2.67
337	3	3	1	2.33
197	2	2	3	2.33
257	2	3	2	2.33
226	3	3	3	3.00
350	3	1	2	2.00

	66th percentile (mean score ≥2.33)
	Under 66th percentile

6a.2.5 Sensitivity analysis

To explore the importance of engagement, outcome measures for participants categorised as having 'higher engagement' with the online programme were compared to participants categorised as having 'lower engagement'. Mean differences were used to compare the groups and these were explored for statistical significance using the Students t-test (Table 35).

Table 35. Outcome measures for participants classified as 'more engaged' compared to those classified as 'less engaged'

		Classification of engagement			Statistics
		Higher		Lower	Mean difference
Outcome measure	n	Mean (SD)	n	Mean (SD)	(95% CI)
CTS-R-Pain Score	9	1.9 (0.18)	5	n/a	n/a
Change in PABS-PT F1 (biomedical)	9	-2.11 (5.73)	5	1.4 (1.14)	-3.51 (-9.26; 2.23)
Change in PABS-PT F2 (psychosocial)	9	0.57 (3.32)	5	-2.4 (3.36)	2.26 (-1.1; 7.01)
Knowledge	9	27.72 (1.8)	6	24.67 (3.54)	3.06 (0.08; 6.03)
Self-efficacy: assessment	9	6.12 (1.94)	6	4.85 (1.81)	1.34 (-0.82; 3.5)
Self-efficacy: group	9	6.99 (1.05)	6	5.02 (2.01)	1.97 (0.27; 3.67)
Satisfaction	9	3.67 (0.87)	6	3.83 (0.41)	0.17 (-0.66; 0.99)

Figure 25 graphically represents the differences in outcome measures between the two categories of online participants. Change in PABS-PT factor one and two scores are presented separately in Figure 26 due to the different axis scale.

Figure 26. Group means for secondary outcome measures comparing most and least engaged participants

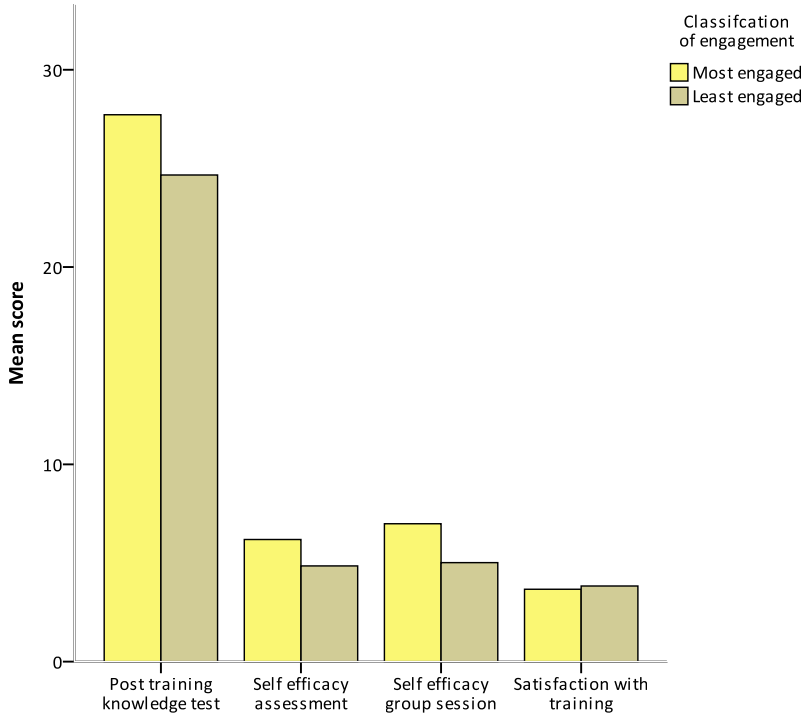
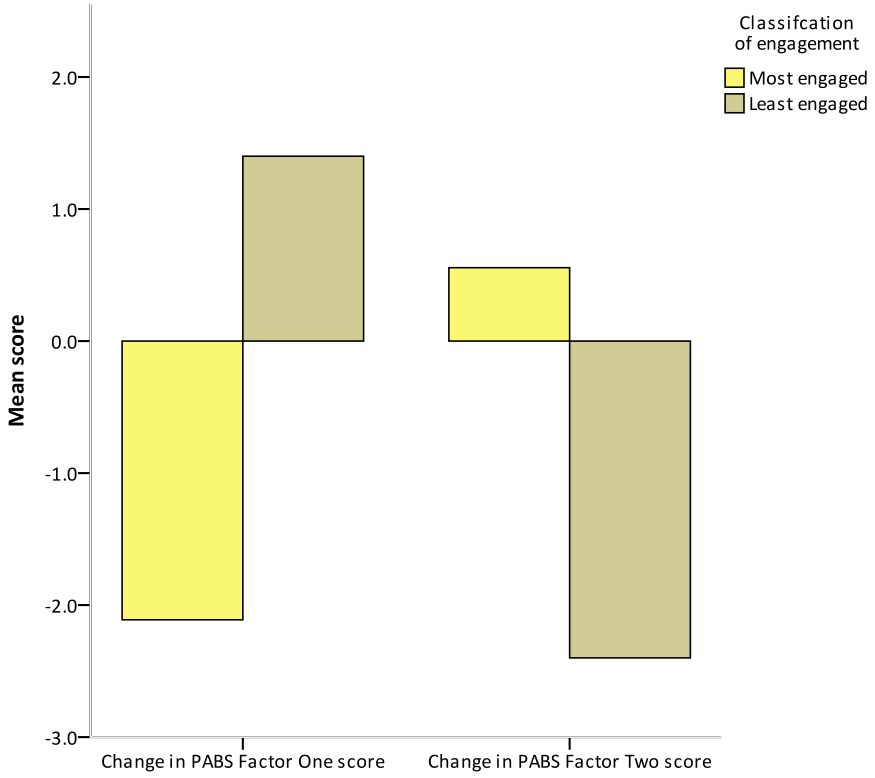


Figure 27. Group means for change in PABS factors one and two comparing most and least engaged participants



Participants classified as having higher engagement with the course had higher knowledge scores, reported greater group and assessment self-efficacy, showed a larger increase in PABS-PT factor two score and decreased their PABS-PT factor one score as desired. In contrast, those categorised as having lower engagement with the programme showed negative training effects, increasing their PABS-PT factor one score and decreasing their PABS-PT factor two score. Thus suggesting that getting participants to engage in the online course is important and may improve learning outcomes.

6a.2.6 Degree of access to the website accompanying the face to face training

The website designed to supplement the face-to-face training was accessed by 5 participants (31%). The number of times it was accessed ranged from 1 to 16 times. Participants who logged into the website accessed all available materials.

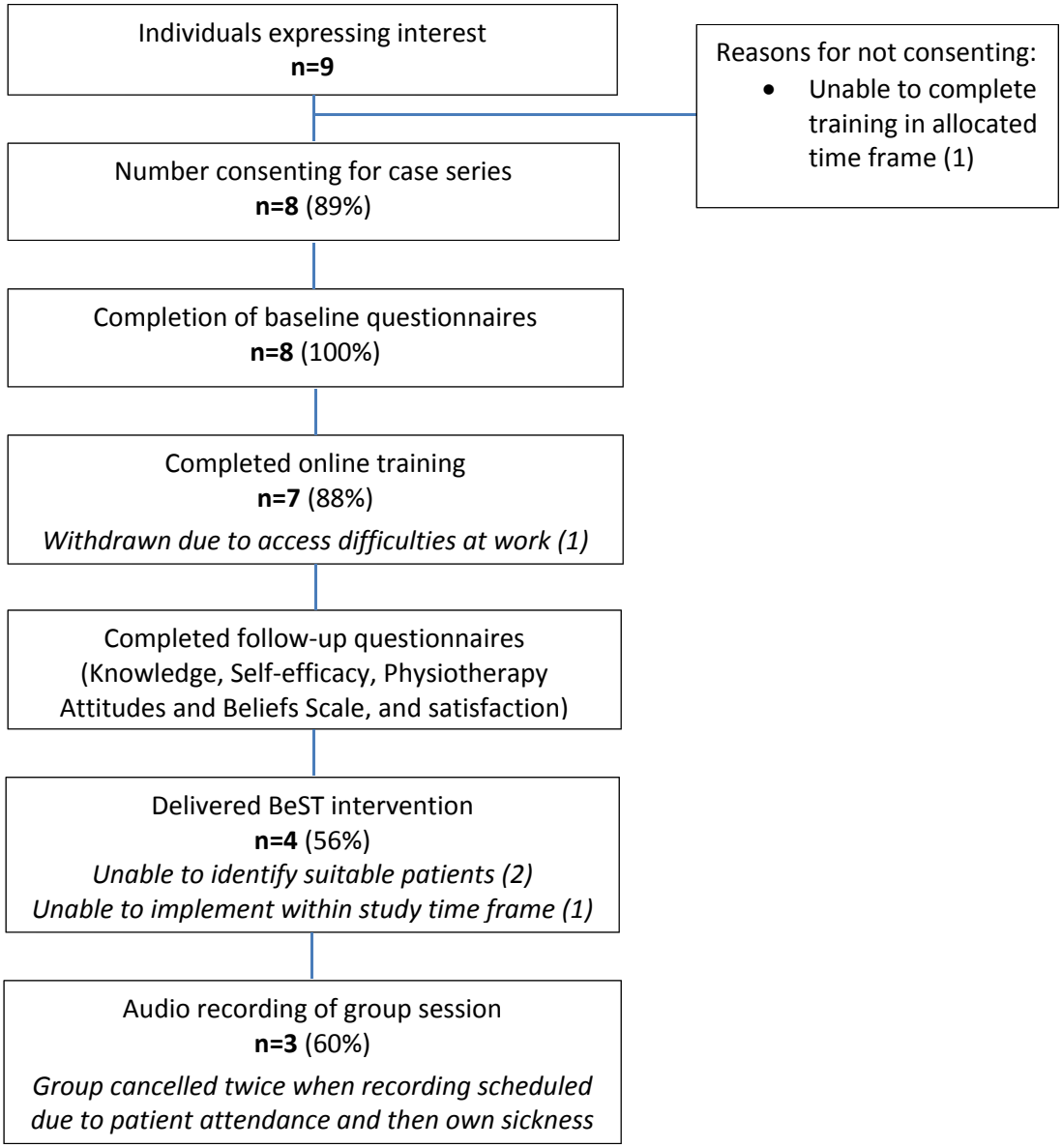
Chapter 6b - Case Series

After closing study recruitment and running the face to face training, physiotherapists from participating sites expressed an interest in the training, asking if they could be involved in the trial. These therapists provided an ideal opportunity to gain further feedback on the online training course i-BeST, and were therefore consented to participate in a parallel, non-randomised, case series.

6b.1 Flow of case series through the study

Figure 27 shows the flow of case series participants through the study.

Figure 28. Flow of participants through case series



Of the seven therapists consenting to take part, all completed the training except one, who had problems accessing the course. Four of the seven case series participants delivered the BeST intervention, with the other participants unable to identify enough patients to run the groups (2) and unable to set the groups up within the study timeframe (1). Only three of the potential four audio recordings were collected due to a lack of patient attendance and therapist sickness.

6a.2 Baseline data

Baseline data for the eight participants in the case series is presented in Table 36, along with the baseline data from the RCT participants for comparison.

Table 36. Baseline demographics for participants in the case series compared to those in the RCT

Category	Face-to-face n=19	Online n=16	Case studies n=8	Total n=43
Sex				
Male, n. (%)	7 (36.8)	3 (18.8)	2 (25)	12 (27.9)
Female, n. (%)	12 (63.2)	13 (81.3)	6 (75)	31 (72.1)
Age (years)				
18-25, n (%)	1 (5.3)	2 (12.5)	0 (0)	3 (7)
26-35, n (%)	11 (57.9)	7 (43.8)	2 (25)	20 (46.5)
36-45, n (%)	5 (26.3)	4 (25)	3 (37.5)	12 (27.9)
46-55, n (%)	1 (5.3)	2 (12.5)	3 (37.5)	6 (14)
56-65, n (%)	1 (5.3)	1 (6.3)	0 (0)	2 (4.7)
Years worked in profession				
No.	19	16	8	43
M (SD)	10.08 (8.05)	14.25 (10.87)	17.75 (9.25)	13.06 (9.64)
Median	7	10	15	10
Range	2-30	2-35	6-32	2-35
Training in CBT				
Yes, n (%)	16 (84.2)	12 (75.0)	8 (100.0)	36 (83.7)
Formal, n (%)	5 (31.3)	6 (50.0)	6 (75.0)	17 (47.2)
Informal, n (%)	11 (68.8)	6 (35.3)	2 (25.0)	19 (52.8)
No, n (%)	3 (15.8)	4 (25.0)	0 (0)	7 (16.3)
Access to a computer				
Daily, n (%)	18 (94.7)	12 (75)	8 (100)	38 (88.4)
2-3 times / week, n (%)	0 (0)	2 (12.5)	0 (0)	2 (4.7)
3-4 times / week, n (%)	0 (0)	2 (12.5)	0 (0)	2 (4.7)
4-5 times / week, n (%)	1 (5.3)	0 (0)	0 (0)	1 (2.3)
Location of access				
Work only, n (%)	7 (36.8)	6 (37.5)	1 (12.5)	14 (32.6)
Work and home, n (%)	12 (63.2)	10 (62.5)	7 (87.5)	29 (67.4)
Home only, n (%)	0 (0)	0 (0)	0 (0)	1 (2.3)
Training Preference				
None, n (%)	9 (47.4)	5 (31.3)	4 (50)	18 (41.9)
Online, n (%)	2 (10.5)	4 (25)	2 (25)	8 (18.6)
Face to face, n (%)	8 (42.1)	7 (43.8)	2 (25)	17 (39.5)
PABS-PT Factor One *(biomedical attitudes and beliefs)*				
No.	19	16	8	43
M (SD)	32.05 (7.314)	28.75 (4.374)	29.13 (5.817)	30.28 (6.162)
Median	32	30	29	30
Range	20-49	17-34	22-38	17-49
PABS-PT Factor Two *(psychosocial attitudes and beliefs)*				
No.	19	16	8	43
M (SD)	23.26 (3.347)	23.31 (2.869)	23.88 (3.563)	23.40 (3.148)
Median	22	23.5	23	23
Range	17-29	18-28	18-28	17-29

On average, case series participants had worked for longer in their profession and all reported past experience with CBT. All remaining baseline characteristics were similar across groups.

6b.3 Outcome measures

Descriptive statistics for the categorical outcome measure are presented in Table 37 and for continuous outcome measures in Table 38. Results are presented along with the data from the RCT groups for comparison.

Table 37. Descriptive statistics for the implementation of the BeST intervention

Group	Delivering BeST		Total	Frequency (%)
	No	Yes		
Case series	3	4	7	57.1
Face-to-face	9	7	16	43.8
Online	10	5	15	33.3
Total	22	16	38	42.1

Implementation of the BeST intervention was higher among case series participants, with just over half of the participants delivering BeST (57.1%). Although the numbers are small, this may reflect a more supportive environment, since the case series participants were from centres that delivered the BeST intervention in the RCT detailed in chapter 6.

Table 38. Descriptive statistics for continuous outcome measures with case series

Statistics		Face to Face	Online	Case studies
PABS-PT factor 1 *(biomedical attitudes and beliefs)*	N	16	14	7
	Mean	25.13	27.71	24.14
	SD	6.84	5.33	4.06
	Median	24	27	26
	Range	23	18	12
Change in PABS-PT factor 1 score[+]	N	16	14	7
	Mean	-8.1	-0.67	-5.14
	SD	4.07	4.87	4.41
	Median	-8	0.5	-3.0
	Range	16	18	12
PABS-PT factor 2 *(psychosocial attitudes and beliefs)*	N	16	14	7
	Mean	25.94	22.71	25.14
	SD	4.22	5.14	4.02
	Median	26.5	22	26
	Range	16	16	10
Change in PABS-PT factor 2 score[+]	N	16	14	7
	Mean	2.83	-0.52	1.86
	SD	5.67	3.52	3.02
	Median	3	-0.5	2
	Range	27	12	9
CTS-R-Pain Score	N	7	5	3
	Mean	2.08	1.9	1.82
	SD	0.33	0.18	0.24
	Median	1.93	1.93	1.79
	Range	0.86	0.46	0.47
knowledge	N	16	15	7
	Mean	25.53	26.5	27.43
	SD	3.27	2.96	2.11
	Median	25.75	27	27.5
	Range	10.5	10.5	6
Self-efficacy: assessment	N	16	15	7
	Mean	7.38	5.65	7.4
	SD	1.58	1.95	1.31
	Median	7.9	5.5	7.6
	Range	5.3	8.2	4.2
Self-efficacy: group	N	16	15	7
	Mean	6.45	6.2	5.97
	SD	2.5	1.75	1.24
	Median	7.2	6.5	5.6
	Range	8.6	7.2	3.6
Satisfaction	N	16	15	7
	Mean	4.69	3.73	4.29
	SD	0.48	0.7	0.76
	Median	5	4	4
	Range	1	3	2

[+]*Adjusted for baseline PABS F1 and F2 scores respectively.*

Looking at the data in Table 38, the case study participants showed greater changes in their PABS-PT scores that better reflected the changes noted in the face to face training arm. They also scored higher on the post training knowledge test. However, their clinical competency, reflected in the CTS-R-Pain scores, was low and similar to the RCT participants.

Chapter 7 - Qualitative Methods

This chapter details and justifies the methods used for the qualitative aspect of the mixed methods evaluation. For reference, the chapter begins by re-stating the aim, research question and study objectives detailed in chapter 4, section 4.5.

7.1 Aim

To explore the experiences of physiotherapists receiving the BeST training with the online programme i-BeST.

7.1.1 Research Question

- What were the participating physiotherapists' experiences with and perceptions of the online training resource i-BeST?

7.1.2 Objectives

- To understand participants' thoughts on receiving training in the BeST intervention with i-BeST.
- To understand participant training preference and factors influencing future training preferences.
- To learn how i-BeST could be improved for potential future iterations.

7.2 Study Design

This was an exploratory study investigating the acceptability of the online training programme (i-BeST) through an exploration of participants experiences. Semi-structured interviews were conducted to obtain this information.

7.3 Pilot

All participant material, such as the study information letter and consent form, were piloted with physiotherapy colleagues to check for ease of understanding and clarity. As advocated by Green and Thorogood (115), the interview guide was shown to two experienced qualitative researchers (Dr David Ellard and Dr Felicity Boardman) for feedback

and was modified accordingly. An expert in Internet-based medical education (Dr David Davies) also provided feedback on the interview guide. The interview process and guide were piloted with a physiotherapist who had used the i-BeST training programme during its development phase. This facilitated the refinement of the interview guide and ensured the interview itself ran smoothly and to time.

7.4 Sample

The population being studied were physiotherapists who had received online training in the BeST intervention. This included participants from the RCT detailed in chapter 5 and from the case series, detailed in chapter 5a, yielding a total population pool of 22 physiotherapists. As previously identified in chapter 5, section 5.7.1, a participant's preference may have impacted upon their training experience and their acceptability of i-BeST. Therefore, participants were stratified by training group according to their pre-specified training preference recorded in their baseline questionnaire. This stratification produced 8 categories of participants, illustrated in Table 39.

Table 39. Categorisation of participants according to their preference and training arm

	Preference			**Total**
	Face-to-face	**Online**	**None**	
Online	8 (A)	6 (B)	8 (C)	22
Face-to-face	8 (D)	2 (E)	9 (F)	19
Total	17	8	18	43

A purposive sampling strategy was used initially to obtain a sample relevant to the aims of the study (121). This study aimed to explore the acceptability of i-BeST and therefore, the sampling strategy only included participants in the online training arm. Thus, the strategy

began by initially inviting two participants from category A, two from category B and two from category C. Participants in groups D, E and F were not initially sampled as they received face-to-face training and therefore, could not discuss their experiences with the online training programme. Analysis of early data guided future sampling, allowing future data collection to be responsive to the data (101). This resulted in interviewing two face-to-face participants to explore themes that had emerged from early data analysis.

7.4.1 Determining sample size

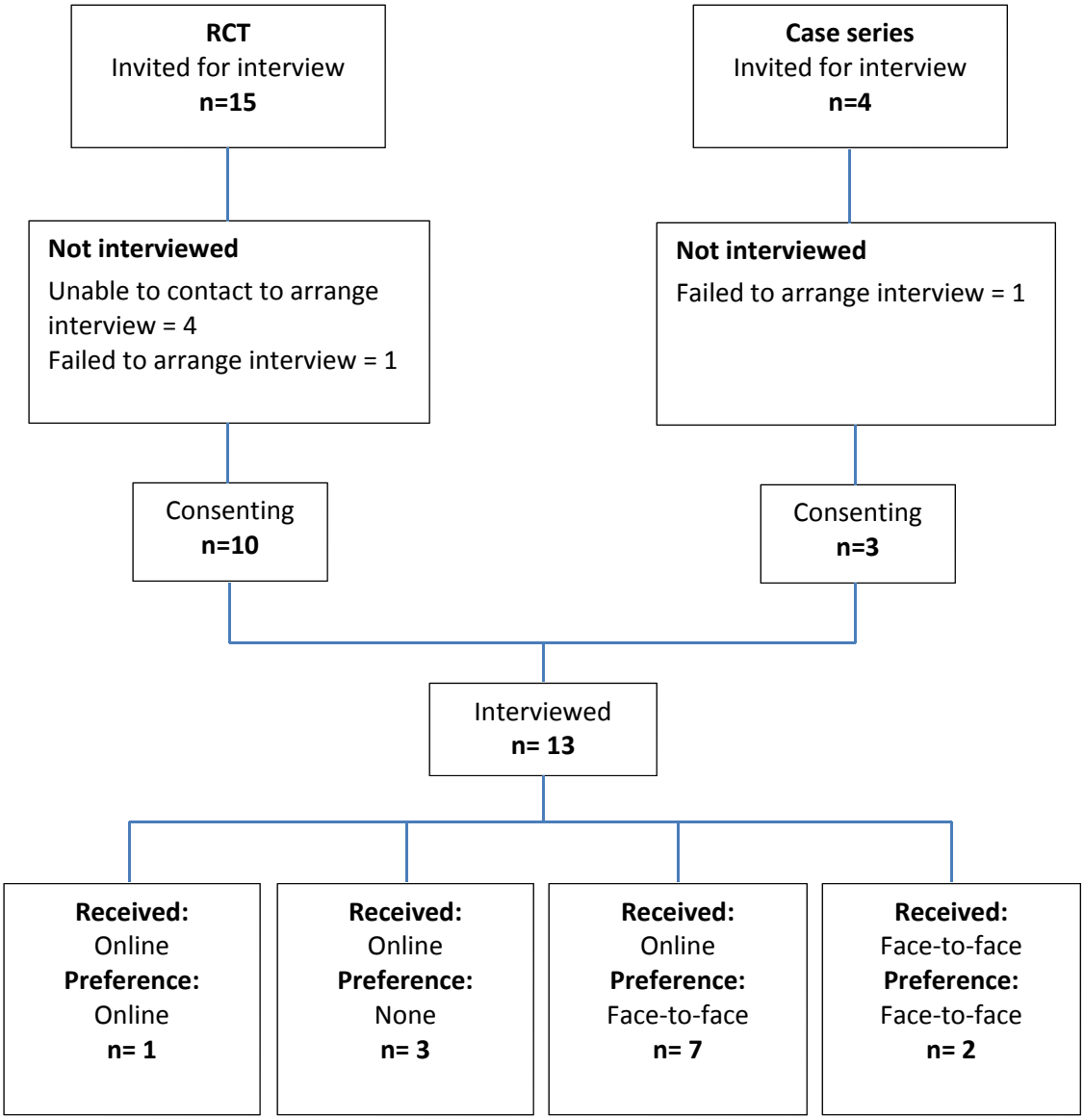
There is sparse guidance as to what constitutes an adequate sample size in qualitative research; instead, researchers are advised that there is no definitive right or wrong answer (115; 117). Green and Thorogood (115) stipulate that the size of the sample to be interviewed is dependent on the number that will be credible to the users of the research. One methodologically robust strategy for determining sample size would have been to continue to sample until theoretical saturation of the data had been achieved (128). However, this method of sampling cannot have a pre-determined end date, since the researcher cannot prospectively determine when saturation will occur (115). Since this study was conducted within a pre-specified time frame, this method of sampling could not be used. In an effort to produce alternative guidance for researchers, Guest, Brunce and Johnson (162) re-analysed 60 interviews and found that data saturation had occurred after 12 interviews. Using this work as a guide, and after discussion with an experienced qualitative researcher (Felicity Boardman), this study aimed to interview between 12-15 participants.

7.5 Participant recruitment

Potential interviewees, determined using the sampling framework detailed in table 43, were sent a participant information sheet (appendix 18) and consent form via email, inviting them to take part in an interview. They were informed that the interview could take place at any location convenient for them, such as, their home, place of work or the

University of Warwick. Allowing the participant to choose the setting they felt most comfortable with should have optimised the likelihood that they would feel at ease during the interview (119). In total, 19 participants were invited to take part in an interview, 15 from the pool of RCT participants and 4 from the pool of case series participants. Attempts were made to contact participants via email in the first instance and subsequently by telephone. After four attempts to make contact, five participants did not respond and two failed to arrange a suitable time. One participant had to cancel a scheduled interview on two occasions, which could not then be rearranged. This left a total of 13 participants, who were all interviewed. The flow of participants through this qualitative study is illustrated in Figure 28.

Figure 29. Flow diagram for participants in the qualitative interview study



7.6 The interviews

One person (Helen Richmond) conducted all interviews to ensure internal consistency (163). The interviews were audio-recorded and verbal consent was gained, in addition to written consent, once the recording had started. During the interview, the researcher made field notes when applicable. Open questions were used whenever possible to encourage the participants to talk freely and prompts were used when needed to elicit relevant experiences and thoughts. Table 40 shows the interview guide that was used with the last interviewee. The questions in bold were added to the original guide as the data analysis progressed to explore emerging themes from the data.

The initial two interviews were transcribed verbatim by the researcher (Helen Richmond). Due to time constraints, subsequent interviews were transcribed using an external service (Typeout). During the transcription process, data was made fully anonymous, removing any names and locations that may have identified the participant. All data was kept in a secure locked filing cabinet. As Griffiths (121) recommends, following each interview, the researcher recorded any reflections, interpretations, thoughts, feelings and new insights for consideration in future interviews.

Data analysis commenced after the first interview (sequential analysis), making use of the responsive nature of qualitative data collection and allowing future interviews to be guided by emerging themes from the data (119). Triangulation of the data was used to improve the validity of the findings (163). Where applicable, interview transcripts were compared against the learner analytic data recorded from online participants. This proved particularly useful to validate aspects of the participants described experience with the online training programme.

Table 40. Interview guide with final participant (key questions)

1. What are your past experiences with post graduate training?
2. What do you value in a training programme?
3. What are your thoughts about online training programmes?
4. What would you like to see in an online training programme?
5. At the beginning of the study you gave a preference of being allocated to face to face training/online training or indicted that you had no preference. Can you tell me more about your preference/no preference?
6. Has the training experience impacted on your training preference?
7. Tell me about your experience with the online training…
8. What did you like about the online training, if anything?
9. What did you dislike about the online training, if anything?
10. Did you find the online programme engaging? (Why?)
11. **How did you find learning about thoughts and feelings in session three?**
12. Is there anything else you would to say about the online training?
13. In the end, were you happy with the training you received?
14. **What were your thoughts about delivering the intervention following the training?**
15. **Do you think there are any barriers to delivering the BeST intervention?**
16. **How did you find identifying suitable patients?**
17. **Tell me about your experiences of delivering the intervention…**
18. Did your colleagues at work show any interest in the online programme/the trial?
19. What are your thoughts on the process of becoming involved in the i-BeST study?
20. What did you think of the outcomes used in the study?
21. In what context do you think the online training would work in the future?
22. Would you like to talk about anything else?

7.7 Ethics

As detailed in Chapter 5, section 5.12, this study was given ethical approval by BSREC (reference number 244-10-2012) and gained NHS R, D and I approval from all participating NHS Trusts (8 in total).

7.8 Analysis of interviews

Computer software (NVivo, version 10) was used to aid data analysis.

7.8.1 Inductive thematic analysis drawing on constructivist grounded theory *(Illustrated in Figure 29)*

Identification of codes

Interview transcripts were printed and analysed on paper initially. Analytic coding was the first step of data analysis and consisted of two stages: open coding and focused coding. Charmaz (132) provides an in-depth explanation on achieving analytic coding with these two stages and was used as a guide throughout the process detailed below. Following analytic coding of each interview, a participant summary was produced to record the researcher's reflections and any notes to consider for future interviews (for an example, see appendix 19).

Analytic coding

Early conceptual labels were created through open coding, whereby the transcripts were analysed line by line, fracturing and opening up the data. Wherever possible, these conceptual labels reflected actions and careful attention was paid to ensure that they closely resembled the data. Where codes were not firmly apparent, they were placed in brackets and were looked for in future transcripts. Open codes were compared within and between interviews through all data analysis, ensuring constant comparison. Disconfirming or contradictory codes were noted as data analysis progressed. This initial open coding provided early insight to guide further data analysis and data collection.

Once an interview had been analysed with open coding, focused coding then began. This involved consideration of the most significant or frequently cited earlier codes, making decisions about which codes provided a conceptually sound analysis of the data. Focused coding resulted in codes that could explain larger segments of the data. The process of moving from open to focused coding was not linear, with much iteration between the two phases. Prior to commencing the next stage of data analysis, an experienced qualitative researcher (Esther Williamson) examined the early analytic coding and two interview transcripts. The interviews and codes were discussed, providing new insight and bringing a broader perspective to the data analysis. This brought greater depth to the analysis and ensured that the analytic codes made sense with the data.

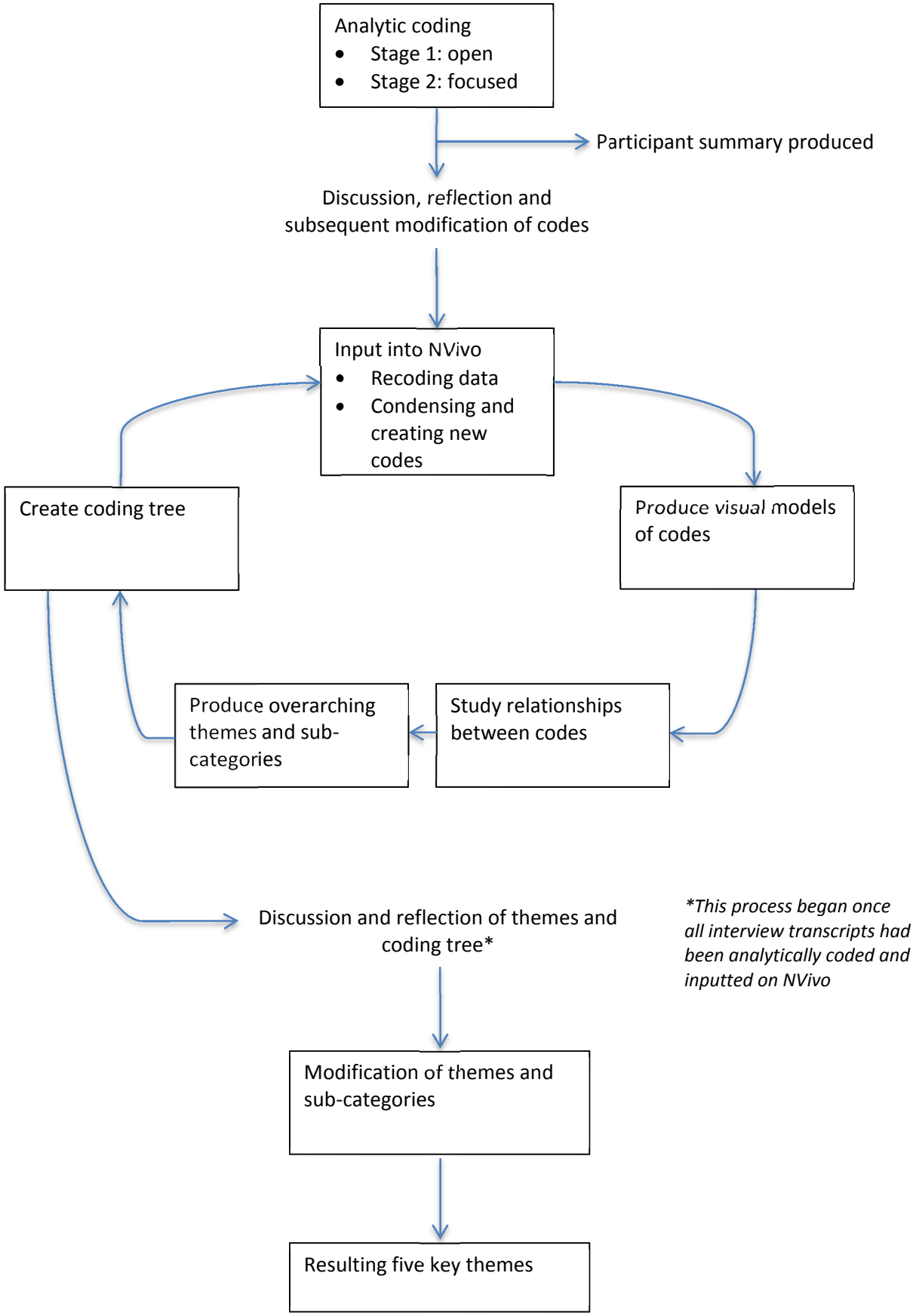
Emergence of themes

Following the initial process of analytical coding and subsequent discussion, data were re-examined and codes were modified where applicable to account for new reflections. Interview transcripts were then uploaded into NVivo and each analytic code entered as a 'free node'. Each transcript was then re-coded in NVivo, assigning text to the relevant node. During this process, existing nodes were condensed or merged and new nodes were created. The model function in NVivo was used to visualise all sub-nodes of a parent node. This then allowed nodes to be visually moved around, helping to depict relationships and associations between the nodes (164). Studying the existing nodes in the context of the data and using these visual models created overarching categories, sub-categories and links that encapsulated and made sense of the data. These categories and sub-categories were tabulated into a 'coding tree' and acted as a guide to facilitate analysis of the remaining interviews.

For each new interview, the process of analytic coding was repeated with the overarching categories and sub-categories continually being moulded to reflect each new piece of data. Following analysis of all interviews, the categories and sub-categories were modelled and

discussed with the same experienced qualitative researcher (Esther Williamson). Through this discussion and examination of categories, sub-categories, relationships and associations, five key themes became evident. A narrative account of each theme was then produced, describing each category using verbatim quotes from the data to support the descriptions (119, 163). Participants were referred to by their study number to protect their identity.

Figure 30. The cycle of data analysis for interview transcripts



7.9 Ensuring Methodological Quality

Reflexivity

Malterud (165) states that a researcher's background and prior experiences will affect many aspects of the research process, from the choice of what to study and the methods with which to study it, to deciding which results are most important and how they should be interpreted. In line with this, Haraway (166) states that our knowledge is 'partial and situated', resulting in different interpretations of the same situation depending upon the individual perspective and background of the observers. These individual perspectives and backgrounds will influence and limit what is observed, and therefore, the position of the researcher must be accounted for at all steps of the research process (163, 165).

Reflexive stance of Helen Richmond

Throughout this study the researcher maintained a reflexive approach, taking into account the potential influences the researcher may have had upon the interview process and outcomes of the study (128). This process began by considering any preconceptions that I might have bought into the research process, what motivations and qualifications I had to explore this field of study, what my theoretical interests were and if I had any prior beliefs regarding the field of study (165). My reflexive stance going into this qualitative exploration is provided below:

'Coming from a health care background (physiotherapy), I have had some prior experience with online learning in the NHS and, whilst the flexibility of learning and the convenience of not needing to travel were beneficial, I found the medium difficult to engage with and prefer to attend courses taught via a face-to-face tutor. Going into this evaluation, I was not sure if participants' would be as happy to learn from an online resource, or if it would teach them the necessary practical skills. Therefore, despite dedicating a considerable amount of time to developing the online training programme, I was not sure how physiotherapists would react to it. I was very motivated to evaluate the programme so that

its potential for future use could be explored, as it could improve access to clinical training and provide a platform to easily update content as new evidence becomes available. The results of the evaluation would not have been either beneficial or detrimental to me personally or professionally. I had not had much prior experience with qualitative research, which influenced my data analysis decisions, deciding to analyse the data with a thematic analysis that drew on grounded theory.'

Reflexivity was ensured at all stages of the research process by employing the following strategies:

- Writing a clearly defined protocol detailing the specific aims and methods prior to commencing the study (167).
- Consulting with several experienced qualitative researchers to get feedback on the study methods, such as the interview guide (119).
- Making reflexive notes following each interview (121).
- Engaging with an experienced qualitative researcher to code a number of interview transcripts at different time points, discuss summary codes, and discuss the final themes that emerged from the data, and lastly, by ensuring that transparency was maintained throughout the research process (127).

Transparency

A clear audit trail was kept, including a record detailing any changes that were made to the coding tree and ensuring safe keeping of old versions, allowing other researchers to follow the study processes and ensuring transparency of the research process (119). The data analysis also included any deviant or disconfirming cases, improving the validity of the findings (119).

Validity

Analytic coding and summaries of the first two interview transcripts was conducted by a second researcher with postdoctoral experience in qualitative data analysis (Esther

Williamson). This researcher was completely independent of the BeST trial and the development of i-BeST. They found the researchers (Helen Richmond) analytic codes described and reflected the data well. They also offered further interpretations and suggestions for exploration in future interviews. During later consultations, Esther Williamson provided valuable advice on how to condense and refine the coding tree and helped to synthesise the end categories and sub categories, facilitating the development of the final five themes that emerged from the data. This process of involving an external, experienced researcher ensured consistency, improved reliability and reduced researcher bias (119).

7.10 Resources

The University of Warwick provided the use of an audio recorder, transcription software, and the qualitative analysis software, NVivo.

7.11 User Involvement

User involvement has been recognised for its importance and added value to all forms of research (120). Therefore, physiotherapists were involved in the pilot stage of this study, providing feedback on the participant information sheet, consent form, interview guide and the interview process itself.

Chapter 8 - Qualitative results

8.1 Participant characteristics

A total of 13 participants were interviewed over a 6-month period from June 2013 to December 2013. The characteristics and relevant quantitative outcome measures for the sample are detailed in Table 41. Participants were from a variety of age categories and had worked in their profession for a range of 6 to 35 years. There was only one male participant in the sample. Seven participants had a training preference for face-to-face training, one participant had a preference for online training and five participants indicated that they had no preference. Of those with a preference, six were allocated against their preference and two were allocated to receive their preference. Nine participants recorded having some previous experience with CBT. Ten participants reported being satisfied with their training, three of which were rated as 'very satisfied'. Two participants were neither satisfied nor unsatisfied, and one participant was unsatisfied.

Looking at the relevant quantitative outcome measures, participants post training knowledge scores ranged from 21 – 30. Their change in PABS-PT factor 1 score ranged from an increase of 6 points to a decrease of 12 points from baseline. Change in PABS-PT factor 2 score ranged from an increase of 8 points to a decrease of 5 points from baseline. Their self-efficacy to perform the BeST patient assessments ranged from a low of 4 to a high of 9.7 on a 10-point scale. Reported self-efficacy to deliver the BeST group sessions ranged from 1 to 8.4 on the same 10-point scale. From this sample of 13 participants, nine delivered the BeST group sessions and their competency scores ranged from 1.6 to 2.38 from a total score of six.

Table 41. Characteristics of participants in the interview study

ID	208	289	243	258	337	197	257	226	205	247	Case5	Case7	Case8
Sex	F	F	F	F	F	F	F	F	F	F	F	M	F
Age range (years)	26-35	56-65	36-45	26-35	46-55	36-45	36-45	46-55	26-35	56-65	46-55	26-35	36-45
Time in profession (years)	6	35	15	8	31	21	22	31	7	30	31	6	18
Preference	FP	NP	FP	FP	FP	NP	OP	FP	NP	FP	NP	NP	FP
Method of training	Online	Online	Online	Online	Online	Online	Online	Online	Face	Face	Online	Online	Online
Experience of CBT	None	Yes	Yes	None	Yes	Yes	None	Yes	None	Yes	Yes	Yes	Yes
Follow-up PABS F1 score*	24	34	25	27	35	25	21	17	39	30	26	26	29
Follow-up PABS F2 score^{+}	18	31	20	23	20	25	32	26	22	25	30	21	26
Follow-up knowledge^{+}	26	27.5	29	24.5	27	27	29.5	30	24.5	21	27.5	29	26
Satisfaction	S	N	S	US	VS	S	S	S	VS	S	VS	S	N
SE Assessment^{+}	9.7	8.9	4.4	5.1	5.9	6.1	4	6.5	6.6	4.4	7.6	9.7	8
SE group^{+}	8	8	8.4	7	6.5	6.5	6	7.3	6.9	1	4.5	6	5.2
Change in PABS F1**	-1	4	-8	1	6	-5	-12	0	-10	-7	-12	-10	-2
Change in PABS F2^{++}	0	4	-2	1	-5	-2	4	0	1	3	8	-1	2
CTS-R-Pain score^{+}	1.79	1.93	n/a	n/a	2	n/a	2.13	1.67	2.38	2.36	n/a	2.07	1.6

FP=face-to-face preference; NP=no preference; OP=online preference; VS=very satisfied; S=satisfied; N=neither satisfied nor dissatisfied; U=unsatisfied

**=lower score denotes better outcome; $^{+}$=higher score denotes better outcome; **=decrease in score denotes better outcome; $^{++}$=increase in score denotes better outcome*

8.1.2 Timing and location of interviews

All interviews took place at participants work, either in a private clinic room or an empty staff room. No interview took longer than one hour, with the total duration ranging from 16 to 60 minutes.

8.1.3 Current stage in the implementation of the BeST intervention

While nine participants in this sample delivered the BeST intervention, each was interviewed at different time points in relation to its implementation. At the time of the interview, three participants were in the process of conducting patient assessments and identifying patients for the group sessions. One participant had not yet progressed to the patient assessments and was considering how to select potential patients. The remaining five participants had all delivered one or some of the BeST group sessions at the time of the interview. One of these had completed a single group session, two had delivered two group sessions, one had delivered three group sessions and lastly, one participant had completed a full cycle of BeST and delivered all 6 group sessions.

8.2 Reflections and experiences of physiotherapists

The coding tree produced from the inductive thematic analysis is shown in Table 42 and illustrates the five overarching themes that emerged from the data and the key categories contained within each of them.

Table 42. A diagram showing the resulting coding tree

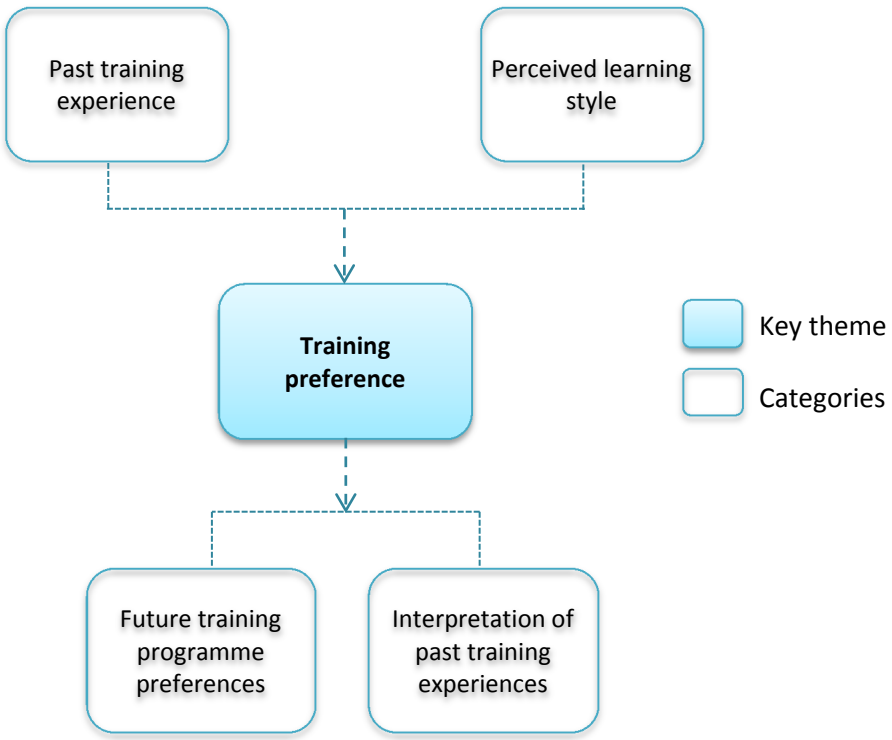
Overarching themes	*Main categories*
The influence of preference on past and future training	Perceptions of training methods Past experiences with training methods Perceived learning style Measures of a good training course
Reflections on actual training experience	Barriers to online learning Online behaviour Positive experiences Negative experiences Influence on preference
Impact of the training	Reactions Acquisition of knowledge, skills, attitudes, beliefs and confidence Behaviour change – transfer of learning Observed effectiveness
Implementation	Concerns and anxieties around delivering BeST Actual experiences of delivering BeST Thoughts on future implementation
Experiences of trial processes	Reasons for taking part Thoughts on study information Thoughts on outcome measures Expectations

Each of the five themes are defined and narrated below.

8.3 Theme one: the influence of preference on past and future training

A key theme that emerged from the data was that a participant's attitude towards their training and their actual training experience could be influenced by their prior training preferences. These preferences were complex and were largely determined by the individuals past experiences and their own perceived learning style. Figure 30 illustrates the key categories within this theme, which are then defined and expanded on below.

Figure 31. A visual model of theme one



8.3.1 Past training experiences (prior to participation in this study)

Definition:
Past experiences with any online or face-to-face training viewed as relevant by the participant.

Participants had a wealth of post graduate training experience, all of which was through face-to-face methods or involved at least some tutor contact time. Most of their past training had consisted of practical elements and was based in the musculoskeletal field. Four participants had been on previous CBT training. All participants had at least some

prior experience of online training through mandatory NHS training, which was, in many cases, viewed in a negative light.

> *"I don't feel we really learn anything because it's just its got to be done and you've got to get though it…"*
>
> i-BeST258 (Received online; face-to-face preference)

> *"...the information governance, there's so much to read and it's so bland, that that's really hard work."*
>
> i-BeST197 (Received online; no training preference)

Participants' confidence with a computer was linked with their past training experiences. Three participants felt that they were not very competent on a computer, while three more described themselves as only fairly competent. Those reporting lower confidence were more likely to report a bad past experience with online training.

> *"I mean, my computer skills are better, they weren't very good, so I can find my way around it but then, you know…"*
>
> Case05 (Received online; face-to-face preference)

> *"I don't think I'm particularly brilliant."*
>
> Case08 (Received online; no training preference)

8.3.2 Perceived learning style

Definition:
Participants' perceptions, attitudes and beliefs about how they learn best, and the methods of delivery and type of content deemed optimal for them.

When discussing their attitudes towards and experiences with past training, participants often made reference to their style of learning. They recognised that with certain methods of learning, they could better absorb and apply new information, indirectly referencing a 'learning style'.

> *"I think it's just a personal preference to how I learn."*
>
> i-BeST243 (Received online; face-to-face preference)

A large majority of participants specified that they find it easier to learn when they can socially interact with their peers and a tutor, saying that the ability to clarify questions and talk kept them more engaged with the learning process.

> *"…having the ability to talk to people about it and just kind of discuss the points through I would find easier to learn."*
>
> i-BeST258 (Received online; face-to-face preference)

> *"…because I like the interactive-ness of discussion and yet feeding off ideas from other people so I probably work better from that point of view than on a computer."*
>
> i-BeST243 (Received online; face-to-face preference)

While the majority of participants felt that group-based work enhanced their learning, others could see advantages to both types of training.

> *"I think it's probably good to be in the habit of doing some independent learning rather than being sort of spoon fed but I think group learning probably cements it."*
>
> Case08 (Received online; no training preference)

Additionally, participants referred to the methods through which the content was delivered, finding that they leant best through visual stimuli and through practice (skill rehearsal). Lastly, some participants felt that a more didactic style of teaching was more suited to their learning style.

> *"I am someone who…I learn a lot from looking at and observing…I find that is very beneficial for my learning…"*
>
> Case07 (Received online; face-to-face preference)

> *"It's not as easy, is it, as actually turning up into a lecture room and somebody's, as I say, spoon-feeding it in."*
>
> Case05 (Received online; face-to-face preference)

8.3.3 Interpretation of past training experiences

Definition:
Insights, opinions, attitudes and beliefs regarding different forms of past training (online and face-to -face).

Prior to commencing the training in this study, participants perceived that face-to-face training could provide a better learning experience. They believed that a face-to-face environment would reinforce their learning providing the opportunity to discuss, interact, observe, listen and practice with peers. They viewed this social interaction as a key advantage and strongly desired to learn from others. They also perceived the face-to-face social interaction as a means of gaining a wider scope of knowledge though diverse questioning and listening to the opinion of others.

> *"…they sometimes ask a question that you didn't think of asking, so you learn a bit more that way don't you? You see it from a wider perspective I think, than if it's just you and the computer…"*
>
> i-BeST197 (Received online; no training preference)

> *"…its changeable and you can sort of change the training according to your audience can't you"*
>
> i-BeST243 (Received online; face-to-face preference)

On the whole, participants' perceptions about online learning prior to their participation in the current study were considerably negative. Subsequently, they were initially sceptical about the plausibility of learning the BeST intervention with online methods.

> *"It's something that you need to interact so how on earth can you teach it online? You must need to do it face to face…I did think this is ridiculous"*
>
> i-BeST226 (Received online; face-to-face preference)

They perceived online learning to be harder to learn from and that it would be unable to provide interaction or a means of asking questions in the same way as you would during face-to-face training. This perceived lack of social interaction meant that some participants

viewed online learning as an isolating experience. They also felt that online methods could not provide any substitute for real practice

> *"I don't know whether you remember as much from it, I'm not great at remembering things."*
>
> i-BeST247 (received face-to-face; face-to-face preference)

> *"So the idea of having e-learning doesn't seem interactive."*
>
> i-BeST226 (Received online; face-to-face preference)

> *"…obviously you can't ask questions in the same way."*
>
> i-BeST197 (Received online; no training preference)

Other prior negative perceptions were perceiving that knowledge learnt through online methods would be more limited, harder to engage with, and to apply to their practice. They did note that in some circumstances, online learning could provide an advantage of greater control and flexibility over their learning experience, although this was not always seen in a positive light.

> *"…it is hard because you can't really replace actually doing it, can you really, actually having it as a little role play or just questions and answer type things."*
>
> i-BeST257 (Received online; online preference)

> *"…online training gives you the opportunity to do it whenever you want, at a time that's suitable for you and do it from home as well."*
>
> Case07 (Received online; face-to-face preference)

In summary, prior to participation is this study, participants deemed online learning to be most useful for learning background theory or factual information, but inadequate for learning skills that needed to then be applied to clinical practice.

8.3.4 Future training programme preferences

Definition:
Characteristics and attributes that participants would prefer in their ideal training course/programme.

Participants identified a number of desirable components to their 'ideal' training programme or course. These attributes were derived from participants past experiences, perceptions of different training methods and their perceived learning style. Consistently reported was the need for interactivity, either through interaction with peers in a face-to-face training environment, or through interaction with the computer in an online learning environment. Another commonly reported ideal was the need for the training to be applicable to their clinical practice and to see this applicability during the course.

> *"…having some interactive part to it, is good, because it gets you to think about what you've just read."*
>
> i-BeST197 (Received online; no training preference)

The desire for a practical component to the training often reoccurred, along with the introduction of new content that challenged the learner, conciseness of information, the evidence base behind concepts, the ability to observe skills, a pleasent training environment and a well-respected, engaging tutor.

8.4 Theme two: reflections on actual training experience

For clarity of reading, participants who received the online training are discussed separately to the two therapists who received the face-to-face training.

Online behaviour

Eight participants completed all of their training at home, while the remaining three participants completed their training across work and home environments. Where reported, participants preferred to do the learning in larger chunks of time and to complete it within a few days. However, a whole day's worth of training would have been too long to do in one go.

> *"…it sort of seemed to make sense to do it close together rather than just doing a bit here and a bit there, because it was – I think the closer it's done together it sort of seemed to – you got into it a bit more really."*
>
> i-BeST257 (Received online; online preference)

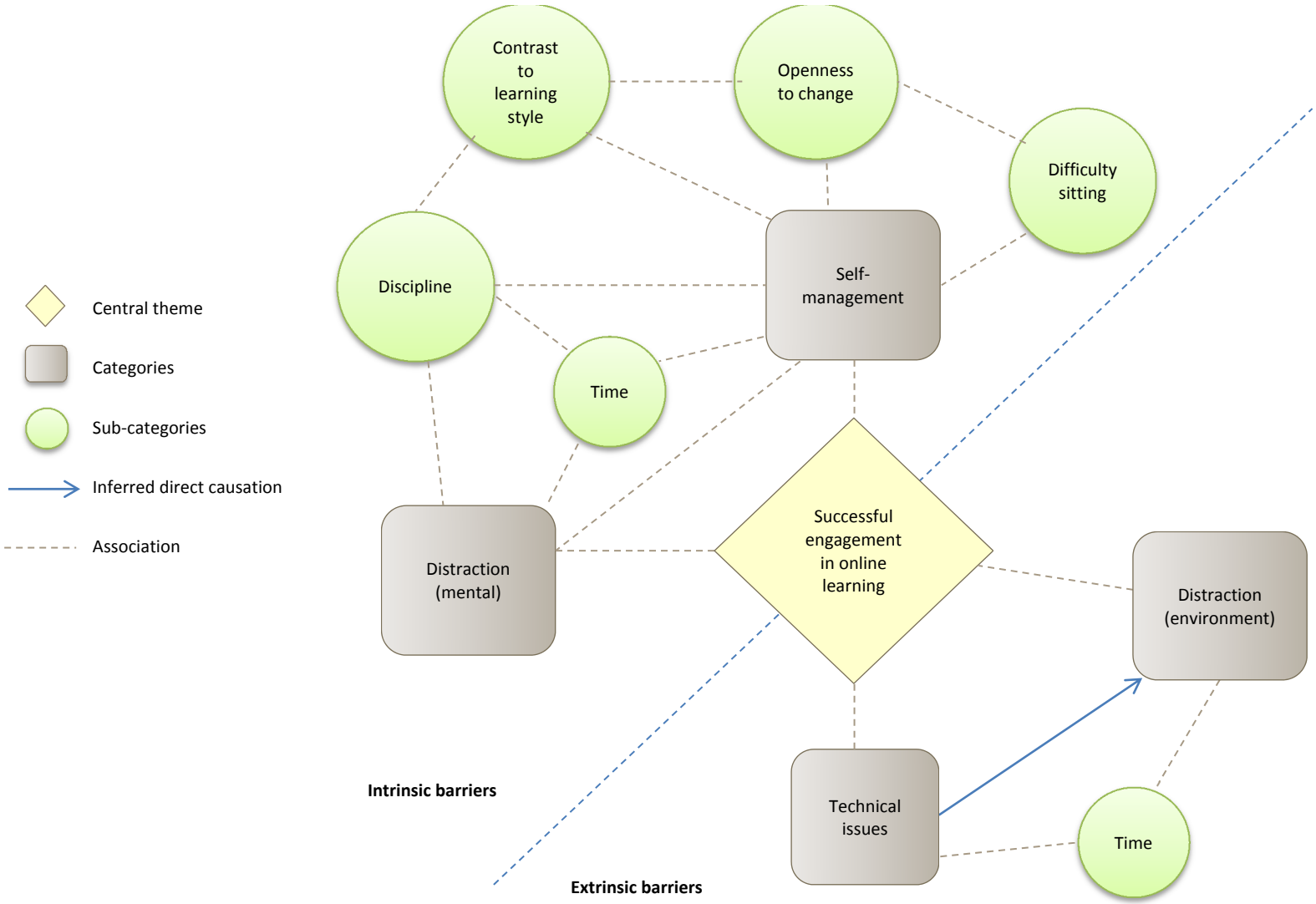
Participants estimation of the time taken to complete the training varied, ranging from eight to fifteen hours. Learning was undertaken in slots of two to five hours depending on the participant, while two participants completed the whole course within one day.

Reflections of participants' online training experience could be devised into three core categories: barriers to online learning, positive and negative reflections, and the impact of their experience on their training preference. Each of these categories is described in detail below.

8.4.1 Barriers to online learning

Through a discussion of participants' experiences, a number of issues emerged that made the process of online learning itself difficult, irrespective of the course content. These barriers could be classified into extrinsic and intrinsic variables and are illustrated in Figure 31.

Figure 32. An illustration encompassing the main barriers to successful engagement with i-BeST experienced by online participants



Extrinsic barriers

A number of participants had technical difficulties gaining access to the online training programme due to out of date web browsing software on NHS Trust computers. This resulted in wasted time and as a result, many participants had to complete their training at home.

> *"I've had a bit of a nightmare…I ended up only being able to do it at home because we couldn't get the Google Chrome here at work at all."*
>
> i-BeST197 (Received online; no training preference)

Some participants perceived this home environment as an advantageous place to complete the training, avoiding the disruptions at work from colleagues and phone calls.

> *"I just felt doing it in the department here, I was going to be interrupted and I wouldn't be able to concentrate really."*
>
> Case07 (Received online; face-to-face preference)

However, many others, often deciding to work at home out of choice, found that 'home' was not an ideal work environment. Here, they were often distracted or completed the training whilst doing other things, such as watching television. Another disadvantage to only having access to the training at home was the lack of synchronicity between their working practice and home environment, thus reducing the likelihood of re-visiting the site.

> *"I suppose because I ended up doing quite a bit of it at home you can be doing something else at the same time as you're doing it…"*
>
> i-BeST337 (Received online; face-to-face preference)

The difficulties in finding an appropriate place to complete the online learning were compounded by busy work schedules and the need to prioritise the training over other aspects of their work load. Participants often viewed this increased flexibility and ownership of their own learning in a negative light, feeling that when you have face-to-face training the day is booked out without the flexibility to change it.

"We've got a really, really busy clinic so it's easy to just prioritise away from that and go, 'Do you know what? I've got to see patients so that's more important.'"

Case08 (Received online; no training preference)

Intrinsic barriers

Setting aside these extrinsic obstacles, participants frequently referred to a number of intrinsic factors that inhibited their online learning. Firstly, they found it particularly difficult to sit for long periods of time, often referring to this as a stark contrast to their profession, where they are on their feet for a considerable amount of time.

"…in a physio department we have a patient for half an hour or an hour and you get up and, you don't have to just sit and do one thing for 7 hours and I think I've never worked at a computer for that length of time, so I think it just amazed me how uncomfortable it is sitting for long stretches of time."

i-BeST258 (Received online; face-to-face preference)

Another intrinsic barrier was the need for self-discipline to work through the online training comprehensively. Participants found it difficult to avoid the urge to skip through elements of the course, noting that as with all online learning, it is easy to take shortcuts.

"…you kind of think, "Actually, do you know? I'm not going to do training, I'm going straight to the test and just do the test," so I think you can, you could possibly take quite a lot of shortcuts with it."

i-BeST337 (Received online; face-to-face preference)

"…that's again maybe my laziness that if there's a way to cheat I will."

i-BeST226 (Received online; face-to-face preference)

"I think the only reason online learning for us particularly here, and me personally here, is not appealing is because you have to self-manage."

Case08 (Received online; no training preference)

In addition to this, they found it difficult to concentrate when looking at a screen for a period of time and one participant struggled to engage in the online programme without the ability to discuss and interact with others. Loss of concentration was often associated

with the training environment, becoming easily distracted when working at home or trying to multi-task.

> *"It's mainly the asking questions that keeps me engaged. There's not that contact with online, you're just staring at a screen. So there's really no point."*
>
> *i*-BeST208 (Received online; face-to-face preference)

> *"I might be doing it and I might also be watching TV at the same time, so I suppose sometimes you might not give it your full concentration really."*
>
> i-BeST337 (Received online; face-to-face preference)

Lastly, the willingness of participants to try new methods of learning without being held back by their preconceptions, i.e. their openness to change, emerged as an intrinsic barrier to online learning.

> *"I'm probably a bit of a dinosaur in that I would, don't like accepting change but probably it's a better way of doing it."*
>
> i-BeST226 (Received online; face-to-face preference)

> *"I just thought I'll do it but I really wanted face to face. I'm a bit of a lost cause."*
>
> i-BeST208 (Received online; face-to-face preference)

Both intrinsic and extrinsic factors appeared to be interlinked, each influencing the other with a potentially magnified effect. For example, the intrinsic barrier of discipline was needed not only drive themselves not to 'cheat' and skip pages while working through the course, it was also required in order to prioritise and book allocated time in which to complete the training, linking to the extrinsic factor of time.

8.4.2 Positive and negative reflections of participants current online training experience

Definition: Descriptions of positive or negative experiences and thoughts regarding their online training with i-BeST.

Table 43 summarises the main positive and negative reflections that online participants discussed, and the accompanying narrative expands on these reflections.

Table 43. Key positive and negative reflections on i-BeST

Positive reflections	Negative reflections
Content • Relevant and interesting • Strategy for delivering concepts • BeST materials • Engaging **Technical** • Interactive (5) • Layout and course structure • Mini-tests • Videos+ • Engaging delivery strategies **Convenience** • Better integration with clinical practice • Control over learning experience • Ability to re-visit the course	**Content** • Thoughts and feelings difficult to grasp • Imbalance of BeST content • Forum: o Did not meet need for discussion o No time to use it o Anxiety around posting a question **Technical** • Not interactive (6) • Unable to re-do mini tests • Length of videos; 'actors' instead of patients • Tricky navigation • Lack of opportunity for skill rehearsal **Convenience** • Printing costs • Time planning: o Lack of guidance on the length of modules o No indication of progression through whole course • Isolating: o Unable to gain opinion of others and ask questions

Positive reflections on i-BeST

Course content

All participants spoke positively regarding the course content, finding it interesting and very relevant to them and/or their patients.

"I don't normally go home and do any work but I didn't find it a problem going home and keeping going because it was interesting…"

i-BeST257 (Received online; online preference)

"Anon and I see all the complex patients here; tend to be all the chronic pain and I just thought, "This is just what we need". It's definitely what we should be doing…"

i-BeST226 (Received online; face-to-face preference)

Participants liked the BeST 'package' since it provided them with a strategy to deliver this knowledge to their patients.

"…but hearing it again, and with a plan, because there's one thing to say this is where pain is, what are you going to do about it? Another to say this is what you're going to do about it - and this is how you're going to roll it out to your patients. So I think there probably wasn't a lot that was new, but it was just put about in a very complete way with a package to carry over."

i-BeST226 (Received online; face-to-face preference)

They thought that the session narratives and crib sheets were good, although specific timings for each section of the narrative would have been a useful additional guide. Six of the participants referred to aspects of the content or the whole course as being very interesting.

"Yes, it's fascinating, isn't it? I found that bit really interesting."

i-BeST257 (Received online; online preference) – in reference to exploring questions

Technical

Participants also felt that the content was presented with a good variety of methods (mentioned by five participants), exceeding their initial perceptions that the learning would consist of mostly reading large sections of text. All online participants liked the layout of the information on the slides and the overall structure of the course, describing it as logical and well thought out.

"I mean the training that I did for this was good in that you had lots of sort of video clips and things to look at and different resources to look at so you weren't just reading pages and pages of text."

i-BeST243 (Received online; face-to-face preference)

"I think it was incredibly well written really and kind of ... and it was I suppose relatively simple and straightforward and logical, so I suppose it probably fitted with the way I like to think. "

i-BeST337 (Received online; face-to-face preference)

On the whole, participants found the mini-tests a useful way of testing their knowledge and felt they helped keep them engaged with the programme.

"…it made me think about it again really – it's a good way of assessing that you've actually read what you are supposed to read really…"

*i-BeST257 (*Received online; online preference)

"…you had to do a little test and things which was good because it made you make sure you took the information in…"

i-BeST243 (Received online; face-to-face preference)

Ten of the eleven online participants highlighted the videos as the most valuable aspect of the training course. Two of these videos were particularly lengthy, though this was viewed as time well spent. Participants felt that having access to the videos enabled them to see the BeST intervention put into practice and envisage how they should deliver the various components of the intervention. These examples made the learning more applicable to their clinical practice. One participant felt that observation through the videos enabled them to learn new clinical skills such as the use of exploring questions, although they still felt the need to practice the skills themselves.

"…watching the way that she phrased questions…I found that really, really helpful and I think that's probably the most useful part of it really."

i-BeST257 (Received online; online preference)

"I did quite like to see it actually in action because it's a very practical thing and to see how they timed it and paced it and saw the interaction."

i-BeST337 (Received online; face-to-face preference)

Engagement (course content and technical)

Ten of the eleven online participants found the programme engaging, which was a surprise to them. They felt that the varied presentation of materials, interesting content and the fulfilment of gaps in their clinical skills were factors that kept them engaged.

"…you actually think 'Actually I've got quite enthusiastic about it'"

i-BeST337 (Received online; face-to-face preference)

"…you had videos and you were able to click about a bit, so it was more than just sitting, listening or reading."

i-BeST197 (Received online; no training preference)

"I think actually it was a much better variety than I thought. I didn't think that we would see videos. I thought it would just be words and tests really, so I think it was actually very well done."

i-BeST337 (Received online; face-to-face preference)

Convenience

One participant found that the online training enabled them to better integrate their learning with their clinical practice, applying skills with their patients as they worked through each section.

"I think because you are seeing patients in between it made you think about how you could actually apply what you'd just been reading"

i-BeST257 (Received online; online preference)

Four participants described the flexibility of choosing when and where to learn as a positive aspect, enabling them to fit the training in and around their life. One key advantage that participants identified was the ability to revisit the online programme, either to repeat sections that they were not confident in or to refresh their knowledge at a later date. This was deemed particularly useful to provide a means of revision prior to delivering a group session, with one participant likening the online programme to a text book.

"…I could go through at my own pace and I could decide when I wanted to work."

i-BeST208 (Received online; face-to-face preference)

"…the next day you think, 'Do you know I think I want to go back and look at it again before I move onto the next one,' …I think I looked at today's session probably two or three times."

i-BeST337 (Received online; face-to-face preference) - referring to session 3

"…my plan is that I'm going to look at the bit I'm going to be presenting just before, like the week before I do it, so I'm sort of more up-to-date…"

i-BeST289 (Received online; no training preference)

Negative reflections on i-BeST

Course content

Participants found some of the topics difficult to grasp using online methods. This was exacerbated when the content was new and from an area that was unfamiliar to the therapists, such as challenging thoughts and the thoughts and feelings section.

"…even once I knew I was wrong, I couldn't necessarily see why."

i-BeST289 (Received online; no training preference) – referring to thoughts and feelings

"I was thinking with this, like the beliefs and that sort of side of things where I felt I needed someone."

i-BeST226 (Received online; face-to-face preference)

Participants also felt that the content of the sessions was not well balanced, identifying sessions one to three as very comprehensive and long, and sessions four to six as rushed and short. This change in tempo between the first and latter sections created difficulties in planning ahead with their time.

"…session six, dealing with flare ups and things like that, I felt was very rushed, for me I felt that was probably the most important session."

Case08 (Received online; no training preference)

Forum

All barring one participant knew about the forum and none of them used it. A reoccurring theme behind this lack of use was a degree of anxiety about putting a question down in writing, with participants preferring a more informal method of discussion and asking questions.

> *"…when you've not started – it's getting the confidence to put a question on there."*
>
> i-BeST257 (Received online; online preference)

> *"…when you have someone face to face, you feel a bit more comfortable to just start chatting to that person about their thoughts about the subject."*
>
> i-BeST337 (Received online; face-to-face preference)

They did not feel that online discussion through a forum could replace their desire for face-to-face interaction and conversation, feeling that the issue of time was particularly important, preferring to ask a question instantaneously and to obtain a rapid response.

> *"That would not satisfy me chatting online…I'd rather just chat"*
>
> i-BeST208 (Received online; face-to-face preference)

> *"I'm very much an instant person, if I want to know something I'll run and ask and that'll be it, I hate waiting for a reply and that sort of thing."*
>
> Case05 (Received online; face-to-face preference)

Participants felt they would only be inclined to use the forum if they needed to know something specific and two participants felt that using a forum did not match their personality type. Negative past experience with forums further deterred participants from using it.

> *"…it didn't hinder, I didn't need to know, I didn't need any information to complete the course, I didn't think…and that's the only reason you might have gone on and talked."*
>
> i-BeST226 (Received online; face-to-face preference)

"I'm more self-reliant, so I'll work something out myself rather than ask other people."

i-BeST289 (Received online; no training preference)

"I've been on a forum before with the CSP and I closed it - because it was a nightmare."

Case08 (Received online; no training preference)

Technical

Some participants found the navigation problematic, getting lost or often repeating sections to ensure they had not missed any parts. Whilst they liked the sub-sections as it reduced the text on the slides, they sometimes found these sections difficult to re-visit and find.

"We weren't quite sure whether we had completed it and we both ended up going backwards and forwards a little bit."

i-BeST257 (Received online; online preference)

While valuing the mini-tests, they would have liked to have been able to redo them, they also found some of the questions ambiguous.

"I definitely didn't like the fact that I kept failing the test, that I couldn't go and redo them."

Case05 (Received online; face-to-face preference)

Additionally, some participants would have preferred the videos to have been with real patients and for there to have been examples of more difficult patients.

"…it stated that they were actors…and for me that made a massive difference because then you feel they are just putting it on and reading a script…"

i-BeST258 (Received online; face-to-face preference)

Five participants did not feel the course was interactive and three of them emphasised the lack of opportunity to practice and rehearse new skills, such as exploring questions. Contrastingly, one participant was grateful to have been allocated to the online training where they could avoid any role play situations, since they had never enjoyed doing them.

"…I think the talking part of it was the important part…and I found that really difficult to do on my own to a computer."

i-BeST258 (Received online; face-to-face preference)

"I do wonder whether that is not something that you can just observe. I think that's something that maybe you need to practice."

Case08 (Received online; no training preference)

"That's probably one really good thing about the online course then, because I really hate doing role plays."

i-BeST197 (Received online; no training preference)

Participants felt that a greater variety of video, audio and text would have helped to sustain their engagement while covering some of the drier material. Additionally, one participant missed having access to the tutor.

Convenience

Isolation

While three participants found working independently to be no problem, the remaining participants all spoke of issues that related to the experience of isolation, missing the facility to ask questions and chat to their peers.

"…you kind of think, 'Here I am, I'm sitting at home doing this, I wonder how everybody else is getting on?'"

i-BeST337 (Received online; face-to-face preference)

'Oh, I just don't understand this.'…because of course if neither of us understood it, we couldn't help the other one."

i-BeST289 (Received online; no training preference)

Time

In addition to the imbalance of session content, they struggled to plan their time since they found there was a lack of guidance regarding the expected length of each session in the course. Furthermore, they would have found it useful to have had a visible progress

measure so that they could judge how far through the whole course they were, thereby facilitating their time planning to complete the remainder of the course.

> *"You didn't actually know how long this bit would take you, so when you'd got a bit of a gap here, you couldn't necessarily do a whole thing."*
>
> i-BeST289 (Received online; no training preference)

Printing

Three participants found the printing of training and patient materials an annoyance in terms of time and costs.

> *"…printing costs a fortune."*
>
> i-BeST226 (Received online; face-to-face preference)

> *"I struggled to get them to print off."*
>
> i-BeST337 (Received online; face-to-face preference)

8.4.3 Positive and negative reflections from face-to-face participants on their current training experience

Definition:
Descriptions of positive or negative experiences and thoughts linked to their current face-to-face training.

The two participants that received face-to-face training spoke very positively about their training experience. They found the tutor particularly enthusiastic and engaging, teaching difficult concepts with ease, and they particularly enjoyed interacting with peers to learn about their experiences and to hear their opinions. These were all factors that were missed by the online participants when reporting their experiences.

> *"…I thought Anon was really good, like she was really engaging…she's very passionate about it and I'm sure she's delivered it loads of times…she really helped you understand what, as I say, certain aspects of it could be difficult to think about…"*
>
> i-BeST205 (Received face-to-face; face-to-face preference)

"I really enjoyed meeting other people and learning from them…you pick up things from other people as well as just from the training…that was very good…"

i-BeST247 (Received face-to-face; face-to-face preference)

They felt that their learning was reinforced through associated discussions and found the practical activities very useful.

"…helpful to do like a little interview with your partner, so that you were almost practising trying to get it out of someone or explain it to them."

i-BeST205 (Received face-to-face; face-to-face preference)

In contrast to online participants, those receiving face to face training had very few negative reflections of their training experience. Their only negative thoughts about the training were occasional diversions from the current topic, although this was also viewed positively, and not progressing quickly enough through some parts while waiting for peers to gain the same level of understanding.

"…maybe there were times when I thought in my own mind I thought okay I've got this now, but other people were still asking questions, or we were going over something again and I thought if I'd been on my own I could have moved on…"

i-BeST205 (Received face-to-face; face-to-face preference)

"I wonder if on-line training focuses very much more on the subject, where I think possibly it was someone giving you anecdotes it sometimes takes you off a little bit, which broadens it, which it great, but maybe the on-line is a bit more specific."

i-BeST247 (Received face-to-face; face-to-face preference)

8.4.4 The influence of participants current training experience (i-BeST) on their future training preference

Definition:
Description of how (if at all) their training experience with i-BeST has influenced their future training preference.

When asked if their training experience with i-BeST had impacted on their training preference, nine participants said they still held the same preference while four participants felt that their preference could have changed. For online participants with a face-to-face preference, the main reasons for not changing it were the absence of social interaction and the inability to practice skills with others. Factors that may increase the appeal of online learning were cost, accessibility and time.

> *"Stayed the same, yeah, I'd prefer face to face still…I think the content was brilliant and I don't think that's a problem, I think it was just the medium of the delivery of it…"*
>
> i-BeST258 (Received online; face-to-face preference)

For the four online participants who may have changed their preference, the main reason underpinning a potential change from a face-to-face preference to a consideration of online learning was their positive experience with i-BeST. These participants were surprised by how much they had learnt and felt the course was good.

> *"I think it has… I think I would consider more the online training, I certainly would, yeah."*
>
> Case07 (Received online; face-to-face preference)

> *"I think if it was something like that again I probably would say, 'Well actually online is OK'…"*
>
> i-BeST337 (Received online; face-to-face preference)

Both face-to-face participants retained their preference for face to face learning, feeling that their current experience reminded them that they prefer to learn in a face-to-face environment.

"Probably reminded me that I do like being that sort of academic, someone teaching and explaining, yeah I think I probably do, that's what I prefer personally…"

i-BeST205 (Received face-to-face; face-to-face preference)

8.5 Theme three: impact of the current training

Definition:
Descriptions or examples of training outcome including: the reaction of participants to the current training; changes in knowledge, attitudes, beliefs, skills or confidence of participants; and the impact of the training on their clinical behaviour.

After the emergence of this theme, it became evident that the categories and sub-categories within it could be classified according to Kirkpatrick's model of training evaluation (61), detailed in chapter 5, section 5.7.2 and Figure 17. Therefore, data corresponding to each of the four levels in Kirkpatrick's model are described sequentially from the base of Kirkpatrick's hierarchal pyramid to the top.

8.5.1 Level one: participants reactions to the training

Definition:
The reactions of participants to the training they received, refering their satisfaction.

Online and face-to-face participants

Nine of eleven online participants felt satisfied with the training they received.

"I'm glad I've done it, either way. Yeah, I was happy with it."

Case05 (Received online; face-to-face preference)

One participant was satisfied with the content of the training programme, although not with receiving it through online methods, and the other online participant felt unable to judge their satisfaction until they had delivered the BeST intervention.

"In terms of the content of it yes, in terms of whether it was computer or face-to-face not so much, I would have preferred the face to face bit."

i-BeST258 (Received online; face-to-face preference)

"Until I present it I won't really know…"

i-BeST289 (Received online; no training preference)

Both of the face-to-face participants were very satisfied with their training experience. Six online participants specifically referred to the online training as being very good. Across both groups, participants were very enthusiastic about the BeST intervention itself, identifying it as just what their department needed with one participant describing it as:

"…the best thing that could've happened for us in our Trust"

Case05 (Received online; face-to-face preference)

8.5.2 Level two: acquisition of knowledge, skills, attitudes, beliefs and confidence

Definition:
Descriptions or examples that suggest participants have changed their knowledge, attitudes, beliefs or confidence as a result of the training they received.

Knowledge

Online participants

Nine online participants specifically made reference to knowledge that they had gleaned from the online training programme. This may have been referenced in a general format, stating that they felt they had learnt a lot from the training, or given through more specific examples of how their knowledge had improved or changed. Three participants specifically referred to improvements in their knowledge of chronic pain.

"I think particularly the pain…there was some really good expressions and sayings to use with patients…some things that I'd not thought of before…"

i-BeST337 (Received online; face-to-face preference)

"…I've got better tools now to explain it (pain) better."

i-BeST226 (Received online; face-to-face preference)

Three participants made reference to holding a better understanding of behavioural skills, such as pacing and goal setting.

"We talk about pacing in very general ways, whereas there was obviously quite specific guidelines on helping people to find their base line and how to

develop that on from their role than just generally saying don't do everything on one go."

i-BeST257 (Received online; online preference)

Additionally, two participants described the dissemination of their knowledge to colleagues, sharing parts of the training with them.

"…the girl who is here ... she was struggling with one of her patients and I did say, "I've got this really good sheet here on goal setting, why don't you focus that patient" and said "this might be quite a useful thing to do with that person to really get them to focus as to what they want to achieve."

i-BeST337 (Received online; face-to-face preference)

Face-to-face participants

One face-to-face participant reported changes in their knowledge. When discussing their improved knowledge of chronic pain, they described an evolutionary process in their understanding of chronic pain that reflected changes in their attitudes and beliefs, as well as in their knowledge.

"I'm sure potentially everyone when they start as physios you've got this thought that you have to help everyone and get them completely pain free, and actually that doesn't really help with your treatment and your progress because you're not going to-it's being able to recognise that… and not always just dependent on pathology but recognising that people are individuals and so much is going to factor into why they have the pain…"

i-BeST205 (Received face-to-face; face-to-face preference)

They also reflected that their increased understanding and knowledge had helped prevent them from becoming disheartened if their patients were not improving and had enabled them to provide more options for their patients.

"…certainly this understanding of the chronic pain and why things develop like that, it gives you a lot more hope as a clinician that you can help people…"

i-BeST205 (Received face-to-face; face-to-face preference)

No inferences could be drawn regarding the impact of the training on the other face-to-face participant's knowledge.

Participants self-efficacy in their knowledge and skills

Online participants

Participants reported varying degrees of self-efficacy regarding their learning and the transfer of this learning into practice. They tended to feel confident in their new knowledge that was based on familiar concepts, such as pain.

> *"…some of the other sessions it's stuff that we do do in some form…so, you know, we do try and explain pain to patients…we do try and talk about goal setting and pacing…"*
>
> i-BeST337 (Received online; face-to-face preference)

Participants were less confident when considering the transfer of this knowledge to practice, particularly if the concepts were very unfamiliar to them, such as the topic of thoughts and feelings.

> *"I kind of don't ... maybe didn't quite understand enough about today's one about thinking."*
>
> i-BeST337 (Received online; face-to-face preference)

> *"…thoughts and feelings…it was obvious I was rubbish at it…and even once I knew I was wrong, I couldn't necessarily see why."*
>
> i-BeST289 (Received online; no training preference)

One participant had gone on to practice this topic outside of work with their partner.

> *"I was practising yesterday at home and I tried it on my husband about these different ways of thinking and to get him to come up with examples…"*
>
> i-BeST337 (Received online; face-to-face preference)

The use of an exploratory questioning style, which was an unfamiliar skill, was a repeated cause of anxiety, with five participants desiring further practice in the use of exploring questions.

"Anon is so good at it, because she's done it for a long time…I sit there and try to think – oh, I don't know what to do."

i-BeST257 (Received online; online preference)

"I came away thinking I need to practice talking about this, this and this that I haven't got from the course…"

i-BeST226 (Received online; face-to-face preference)

However, two participants specifically described feeling confident to deliver the BeST intervention.

"I've felt with this learning I should be, can do the group now and I felt like I could do it. I wasn't feeling like I don't have the knowledge to do it, I'm not prepared enough to do it. I felt like I could do it."

Case07 (Received online; face-to-face preference)

"I think having had the training in it…I felt much more confident to deliver it…and so it seemed to make a lot more sense about it."

i-BeST258 (Received online; face-to-face preference)

Face-to-face training

Inferences about self-efficacy could only be drawn from one face-to-face participant. They described feeling confident in applying a number of new concepts to their clinical practice.

"…being able to value a lot more and actually have a better understanding of things like pacing and boom and bust…were things I might have vaguely heard of, other colleagues talk about with a patient, but probably not having the confidence to actually structure an assessment or treatment with a patient and say this is what we must try and do."

i-BeST205 (Received face-to-face; face-to-face preference)

As with online participants, they also shared the same reduction in confidence when discussing the transfer of unfamiliar concepts into their clinical practice.

"I think as a concept it made sense…but it was perhaps sometimes the transfer and the thinking about the thoughts into how you then try and help them combat that…I was a bit concerned…because I was like if I don't feel that I

fully get it and then I don't share it very well and then they don't…it's quite a key thing."

i-BeST205 (Received face-to-face; face-to-face preference)

Attitudes and beliefs

During the interview, participants discussed thoughts or aspects of their practice that gave insight into their attitudes and beliefs regarding the management of persistent LBP.

Online participants

One participant from the online group showed evidence that they were starting to change their attitudes and beliefs.

"I think that's certainly made me think about it differently. Starting to think, "Well, these are the exercises we'd maybe like to do, but it's up to you to choose where to start," and I like that side of it."

i-BeST337 (Received online; face-to-face preference)

However, the dialogue of a further two participants was suggestive of no change, indicating that the therapists still held strong biomedical attitudes and beliefs towards their chronic LBP patients.

"…they really want that one-to-one physio, and so you might find that you'd need to do a little bit of that and then filter them off into the group."

i-BeST197 (Received online; no training preference)

"…I don't necessarily think that we can just put them straight into that group without just at least exploring and looking at some of them sort of specific problems they may have because obviously there's going to be lots of muscle dysfunctions and joint stiffness's and things like that that you find."

Case08 (Received online; no training preference)

Face-to-face participants

Again, only one participant provided information where inferences could be drawn about their attitudes and beliefs. This participant showed the greatest shift in their attitudes, both showing evidence of reducing their biomedical beliefs and increasing their psychosocial beliefs.

"…recognising that people are individuals and so much is going to factor into why they have the pain that they have and someone else who might have it the same on a scan will deal with it totally differently."

i-BeST205 (Received face-to-face; face-to-face preference)

Perceptions of change in attitudes and beliefs

In the later interviews, there was the opportunity to ask participants about why, in their opinion, the face-to-face group showed a greater change in their attitudes and beliefs. Those asked felt that enthusiasm from the tutor could be responsible for the observed change in attitudes, and that having to generate your own enthusiasm when working from a computer screen may not be enough to create these changes. They also referred to their peers with the notion that hearing new concepts from multiple sources could also play a role in choosing whether to adopt new ways of thinking.

"…whether just reading it off a blank screen has the same impact as somebody being very enthusiastic in front of you to put the point across."

Case05 (Received online; face-to-face preference)

"…you've only got your own pre-set things in your brain haven't you and you'll probably perhaps carry on looking at things a little bit more from your... your already set beliefs and things."

i-BeST197 (Received online; no training preference)

8.5.3 Level three: behaviour change – transfer of learning

Definition:
Descriptions or examples that suggest participants have transferred their learning into practice, evidenced through changes in their clinical practice.

Inferences regarding the transfer of learning into physiotherapists' clinical practice could be drawn from four online participants and one face-to-face participant, who described examples or situations relating to their clinical practice outside of the BeST intervention.

Online participants

Participants described using aspects of their new knowledge, such as a better understanding of chronic pain or goal setting, with their routine chronic pain patients.

> *"…he has a chronic knee, he's got terrible femoral problems, he's too young to have an operation, he's just got to manage his pain…and I think before I struggled with that, are you telling people it's in the brain and therefore in your head…I've got better tools now to explain it…"*
>
> i-BeST226 (Received online; face-to-face preference)

> *"The videos of that Australian chap getting scratched on his leg – I've told that to no end of patients; I found that really fascinating and I think it just sort of helped to explain that to them."*
>
> i-BeST257 (Received online; online preference)

> *"I have applied it in my practice. So I've had a patient today who has some anxiety about a pain that he has and I said, "What are your thoughts about this pain?" …So I'm obviously applying it, and with an open question as well."*
>
> Case08 (Received online; no training preference)

Face-to-face participant

Similarly to the online participants, this participant described the transfer of new knowledge to their clinical practice, outside of the context of this study and the BeST intervention.

> *"…it's really helped me with other consultations with other patients and being able to recognise psychosocial things better and be able to manage my chronic patients…"*
>
> i-BeST205 (Received face-to-face; face-to-face preference)

In addition to the online participants application of knowledge, this face-to-face participant also described how changes in their attitudes and beliefs had led them to make different management decisions regarding their chronic pain patients.

> *"…actually being able to now recognise that a bit more and have that underneath, just my approach to patients in general helps me not to get*

disheartened if someone isn't improving, yet also still be able to suggest things to them to help them manage things better rather than yeah if we haven't got you pain free in six sessions then there's nothing that can be done, it's like better in assisting them really."

i-BeST205 (Received face-to-face; face-to-face preference)

These changes in clinical practice show evidence of behavioural change through the transfer of learning and were evident to varying degrees among individual participants. Certainly, the face-to-face participant appeared to have changed more aspects of their clinical practice as a result of the training in comparison to all online participants. Their shift in attitudes and beliefs towards a more psychosocial model of health appeared to be a reoccurring factor that influenced the noted changes in their clinical practice. By comparison, participants in the online group showed evidence of transferring aspects of the training, as detailed above, while still appearing to hold biomedical attitudes and beliefs.

8.5.4 Level four: observed effectiveness of intervention

Definition:
The thoughts and observations of participants regarding the effectiveness of the BeST intervention for their patients.

Only four participants (three online; one face-to-face) had delivered some or all of the groups when the interviews took place.

Online participants

Two online participants, who had not yet delivered all of their group sessions, described the positive reactions of patients to aspects of the session content.

"There's one or two of them that have really ... they love that idea…you know the homunculus man stuff and some of them were really fascinated by that…"

i-BeST337 (Received online; face-to-face preference)

"…it was very interesting to see that already she'd changed her way of thinking. So what we've done in the previous sessions had obviously already

influenced her thoughts and feelings about things that she feels overwhelmed with… it wasn't pain that was her focus…"

Case08 (Received online; no training preference)

The third online participant did not report any observations regarding their patients in the BeST group sessions and therefore no inferences could be made.

Face-to-face participant

This participant, who had delivered all six of the BeST group sessions, referred to the observed effectiveness of the intervention as a whole.

"…in a way I was probably a little bit surprised, which I shouldn't have been, but I was a bit surprised at how effective it was…I've seen, even in just this one off group of people, I've seen like a benefit…"

i-BeST205 (Received face-to-face; face-to-face preference)

8.6 Theme four: implementation

Definition:
Participant insights, experiences and future thoughts on or around the implementation of the BeST intervention.

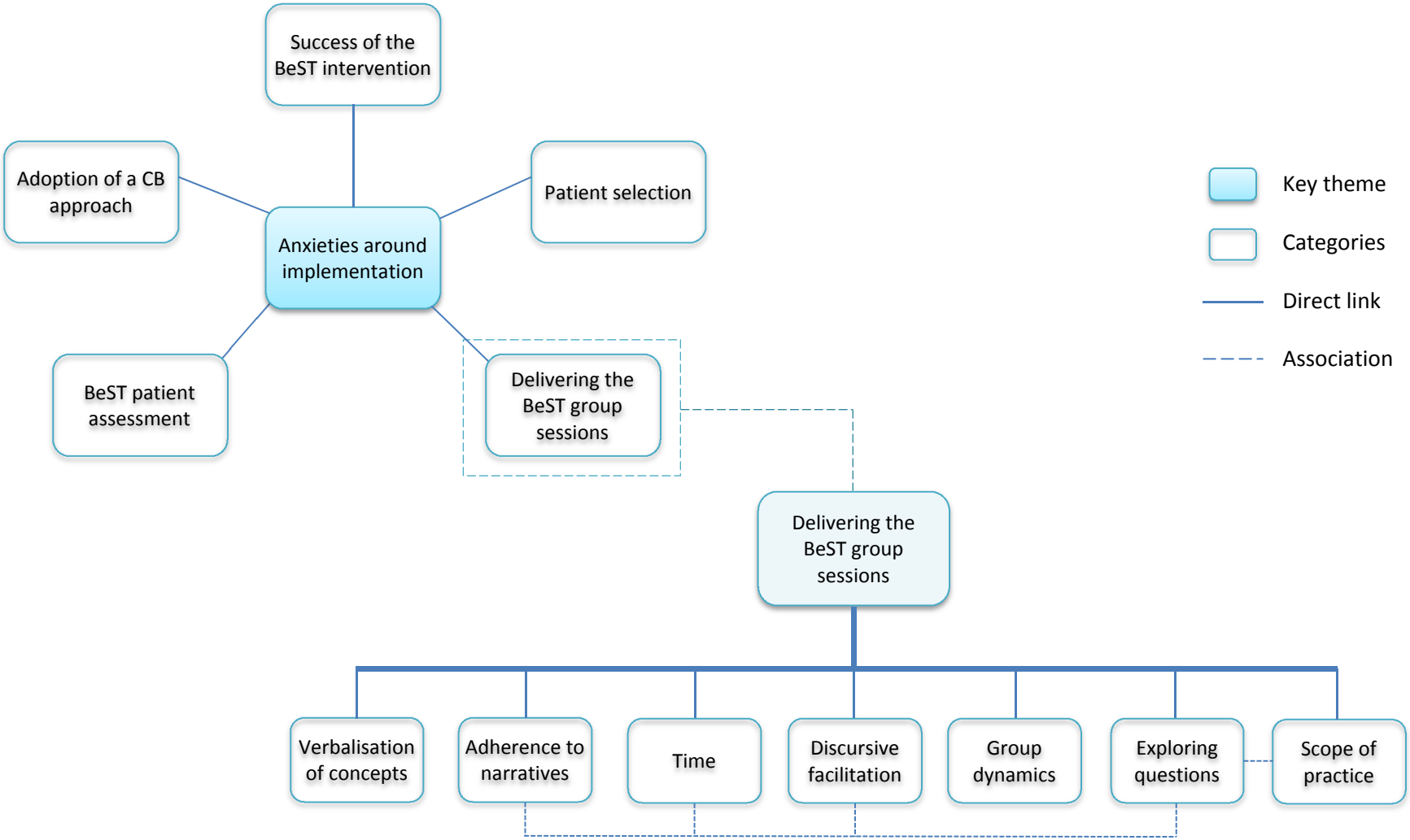
This theme contained three sequential categories: participants' anxieties and concerns prior to the implementation of the BeST intervention, participants' actual experiences of delivering the BeST intervention (where applicable), and their thoughts on the future implementation of both the BeST intervention and of the online training programme, i-BeST. Each category is explained in detail below.

8.6.1 Concerns and anxieties around implementing the BeST intervention

Definition:
Problems and anxieties prior to implementing the BeST intervention.

Both online and face-to-face participants spoke about a number of concerns prior to the implementation of the BeST intervention. These were grouped into five sub-categories with interlinking relationships, illustrated in Figure 32, and detailed individually below.

Figure 33. A model illustrating participants' anxieties prior to implementing the BeST intervention



Anxieties relating to the delivery the BeST intervention itself

Online participants

All online participants were anxious about delivering the BeST intervention for the first time.

> *"Not nervous about taking a group…Just probably just a bit nervous about just getting everything in a nice order and that works for the patients really."*
>
> Case08 (Received online; no training preference)

They held quite general anxiety about verbalising new concepts across to patients and with the reality of having to actually deliver the BeST intervention.

> *"I've read through them all because this is looming over me to do this session."*
>
> Case05 (Received online; face-to-face preference)

> *"I'm a bit anxious… it's years since I've run a group and they were all just ankle classes and that sort of thing, very different to like a sit down type of group really."*
>
> i-BeST257 (Received online; online preference)

Certain aspects of delivering the groups magnified levels of anxiety, such as verbalising the concept of 'thoughts and feelings' in session three, or using the skill of exploring questions. These anxieties were often associated with low self-efficacy.

> *"I'm not going to enjoy doing the exploring the feelings and that, I don't know whether I could eek that out for a couple of hours."*
>
> Case05 (Received online; face-to-face preference)

Online participants reported anxiety around group dynamics, expressing concern over how to handle difficult patients or 'blockers' who might not be conducive to the session.

> *"Yes, because I can see some patients we're going to have a struggle to shut up…"*
>
> i-BeST289 (Received online; no training preference)

This interlinked with their inexperience and anxiety in facilitating the group with a discursive style, knowing when the right time was to 'shut down' conversations and having the confidence to steer discussions.

> *"I'm not experienced enough with that kind of questioning to know when is the right time to close that down?"*
>
> Case08 (Received online; no training preference)

They also viewed the use of exploring questions as potentially daunting and for one participant it was their main concern with delivering the groups.

> *"…again it's the style of asking and you know, we're physiotherapists, we're not, you know, psychologists, so we definitely weren't taught to ask questions like that. I think it's just, my main concern about delivering the groups."*
>
> Case08 (Received online; no training preference)

This anxiety in using exploring questions tied in with a lack of confidence in being able to guide the discussion whilst allowing the patients to, in effect, take the driving seat.

> *"…you're doing most of the talking, whereas this is really you're just sort of getting them to do most of it, to sort of guide it. And I think we'll all, probably because that's not what we're used to, so we're all thinking, woah…"*
>
> i-BeST289 (Received online; no training preference)

In addition, participants felt that using an exploring style of questioning would place further strain on already tight time constraints.

> *"…to do any of these exploratory questions, you just think, "When am I ever going to ask an open ended question?" Because I just can't cope with the time constraints to get the answer."*
>
> i-BeST226 (Received online; face-to-face preference)

They were also unsure how strictly they had to adhere to the BeST session narratives and how to allocate time across the various sub-sections. Concerns regarding this latter point varied from anxiety about filling the whole time slot, to concerns about running over time.

"…there's a particular programme to fit in…and I suppose probably, fearful is the wrong word, but I'm very conscious of trying to keep in within the time frame."

Case08 (Received online; no training preference)

As the gap in time from completing the training to delivering the BeST intervention increased, anxiety around delivering the intervention also increased, with participants feeling concerned that they would need refresh their knowledge and re-visit the online programme.

"Because I'd like to revisit that because it's been so long since I did the training and I thought, "Oh if you're going to start soon I'll need to get that refreshed."

Case05 (Received online; face-to-face preference)

Three participants were concerned about patient compliance over the six sessions noting that, from past experience, dropout rate for this patient group was high.

"…and then actual patient compliance…sustaining them through the whole of the six weeks."

Case05 (Received online; face-to-face preference)

Face-to-face

As with online participants, face to face participants were anxious about delivering the BeST intervention as a whole.

"Quite anxious actually… a bit of a fear of that, that you actually have to carry it out… because I was a bit more daunted about the whole delivering it part…"

i-BeST205 (Received face-to-face; face-to-face preference)

"I don't feel terribly confident about taking the classes, even though I've got the crib sheet, and I actually spent quite a bit of time going over it again…"

i-BeST247 (Received face-to-face; face-to-face preference)

They were also anxious when it came it aspects that were unfamiliar to them, such as the use of an exploratory questioning style.

"…there was maybe a concern as well that…a clinician feeling not skilled enough in actually using those skills with real patients and the potential that they could talk about anything and everything."

i-BeST205 (Received face-to-face; face-to-face preference)

Additionally, one online participant made reference to their colleagues who had completed the face-to-face training, suggesting that they also felt anxious about delivering the BeST intervention.

"Mind you, I don't think the ones of us who went and did the face-to-face training, I think they feel the same about that, so I think there is definitely a bit of something missing, because none of us feel confident in going to do it."

i-BeST289 (Received online; no training preference)

The face-to-face participants did not express the same anxieties as the online participants with regards to group dynamics, facilitation of the group with a discursive style, the session narratives, patient attendance or the time between the training and the delivery of the BeST intervention.

Anxieties around the BeST patient assessment

Only participants in the online group expressed anxieties about the patient assessment and therefore, the narrative below applies only to online participants.

Participants made frequent reference to the unfamiliarity of the BeST assessment, noting how different it was from their usual style of physiotherapy assessment.

"…we don't really feel confident doing the assessment because it's so different…"

i-BeST289 (Received online; no training preference)

They found it difficult not to assess patients from a musculoskeletal perspective, for example, wanting to observe their lumbar spine range of movement and finding it unusual not to undress the patient.

"…and also I kind of feel I probably do need to just look at their movements and do some sort of physical examination because I think that's probably what patients expect of us to a certain extent…"

i-BeST337 (Received online; face-to-face preference)

"So no undressing…I don't know… that's the norm."

i-BeST226 (Received online; face-to-face preference)

They also felt that the assessment was not adequate in some aspects for assessing new referrals, since it did not cover red flag questions or include a neurological screening.

"How are you going to get over the screening for red flags? …But as soon as you're on sciatica, you would have to do a neuro."

i-BeST226 (Received online; face-to-face preference)

They also felt that the recommended assessment time of 1.5 hours was unrealistic given that their longest time slot for a new patient ranged from 40 minutes to 1 hour depending on the Trust. They felt that this limited, to some extent, how much control they could give to the patient, feeling as though they had too much to fit in.

"…I think it was unrealistic to expect us to spend an hour and a half - initial assessment - because normally we get 40 minutes and I managed to spin it out to an hour…"

i-BeST337 (Received online; face-to-face preference)

They would have also liked more guidance on how to introduce the concept of the BeST intervention and self-management with these patients.

"…but it's actually I think that first bit of when you see them, how you actually almost, this is what we're offering you, sort of thing, this is how it'll work, how you link that into…"

i-BeST289 (Received online; no training preference)

Anxieties around the success of the BeST intervention

Participants in both groups showed concern over how effective the BeST intervention would be and hoped that the patients would not end up coming back into the system with the same complaints, having wasted both theirs and their patients' time.

"…just worrying that we would get to week six and everyone would be just the same or worse and they'd be like it was a waste of time kind of thing, and then probably I would feel that that was more my problem than the thing itself, that I hadn't maybe delivered it well enough. So yeah I was quite worried, the reality of it…"

i-BeST205 (Received face-to-face; face-to-face preference)

"…it's a lot of time invested… So I think just a bit, just a bit concerned that it will be effective… And that they won't just end up coming back into the system again."

Case08 (Received online; no training preference)

Anxieties around patient selection

Anxieties around patient selection came from participants in both the online and face-to-face training groups, and therefore, the narrative below refers to both groups of participants. Nine participants described uncertainty or anxiety around the identification of suitable patients for the BeST intervention.

"What I didn't have clear was what patients we would book into the group…we could have a better understanding really about the patients and what types of patients we would put in a group…"

Case07 (Received online; face-to-face preference)

The very open criteria for patients used in the original BeST trial appeared to cause some difficulties for the therapists, who might have found it easier to identify patients with more specific guidelines and stricter criteria.

"…in effect maybe what made it a bit harder was almost we didn't have many … it was quite open, which is good because that means loads of people could come, but I think sometimes we physios like to say this criteria, this, this, this, must have this mustn't have this…"

i-BeST205 (Received face-to-face; face-to-face preference)

The broad criteria for patient selection seemed to result in the therapists adding further selection criteria themselves, particularly around the inclusion of patients thought to hold

particular psychosocial factors, who were therefore deemed more suitable for this type of CB intervention.

> *"…maybe it's more somehow trying to be sensitive to the type of patient that will suit it… from symptom point of view to a degree but also how they are currently coping with it, how they talk about it and maybe being able to recognise some of the points that you learn whilst on the course, you know the catasrophising…trying to be able to pick up those things…might guide you to who would benefit more."*
>
> i-BeST205 (Received face-to-face; face-to-face preference)

> *"…if they're high then they're going to be perhaps depressed, aren't they? I think they might catastrophise and… think they might be too complex…"*
>
> i-BeST226 (Received online; face-to-face preference)

This is an interesting finding when considering the sub-group analyses in the BeST trial itself, which found no association between psychological factors, such as fear avoidance, and treatment effectiveness (38).

For online participants only, the concept of patient selection also linked to participants' attitudes and beliefs regarding the management of chronic LBP. Three therapists stated that they would want to do some manual therapy with patients and address issues of stiffness and muscle dysfunction before referring them to the BeST intervention groups. This suggests that therapists holding more biomedical attitudes and beliefs would be less likely to refer patients into an intervention based on a 'hands-off' CB approach.

> *"I didn't feel that I had any patients that fitted the criteria for, with the back pain, for the group. Or if they did they definitely needed some more specific bits and pieces doing as well so, you know, like I wanted to do some bit of manual therapy - stuff like that."*
>
> Case08 (Received online; no training preference)

> *"I mean, I do think some patients need some hands-on first…"*
>
> Case05 (Received online; face-to-face preference)

Anxiety around adopting a CB approach

Tying into all aspects of delivering the BeST intervention, and present across both training groups, was an anxiety around adopting a CB approach. Participants spoke frequently about how a discursive style of therapy was very contrasting to their usual role, where they were the expert and the one in charge. They suggested that adopting this approach was difficult because it was not what they were used to and they appeared uncomfortable to take a less assertive role.

> *"I'm so used to sort of dictating to the patient, saying this is what you're going to do and then asking them how is it, rather than allowing them to lead. So I kind of struggled to get my head around that…"*
>
> i-BeST208 (Received online; face-to-face preference)

> *"…a big thing with physios is we like to fix things, we're not very good of the kind of 'this is the idea' and then letting people come up with it because it takes a lot of time and I think part of our difficulty…is that we want to do a lot of talking, we want to tell them everything…"*
>
> i-BeST258 (Received online; face-to-face preference)

One participant struggled with the idea that the sessions consisted of predominately verbal activities, such as discussion and problem solving, wanting to add in exercise components.

> *"…there's just that overwhelming urge to think, "Wouldn't it be nice to have 20 minutes where we all did a bit of jogging exercise together," … that's my physio brain because that's the way I've been programmed really…"*
>
> i-BeST337 (Received online; face-to-face preference)

Another participant felt uncomfortable with the pace of a CB approach, again relating back to experience, since they were used to a faster pace of therapy.

> *"I think because of the nature of physio and how we work, we're like so into time and it was really slow but that's the approach you need. I was thinking, 'Come on, hurry up, hurry up.'"*
>
> Case05 (Received online; face-to-face preference)

Scope of practice

Three online participants and one face-to-face participant expressed anxiety around their scope of practise, with uncertainty around how to handle certain responses from patients and knowing how far to explore issues that patients might raise.

> *"So when we're learning about the core beliefs and the idea that we don't go into that…how far we have to explore the psychological issues that you may identify during the session."*
>
> Case07 (Received online; face-to-face preference)

> *"…we've always been told we can't dabble in that without the right training and things… you've got to realise your limitations"*
>
> Case05 (Received online; face-to-face preference)

This was linked to their anxiety of using an exploring questioning technique, feeling that this style of questioning has the potential for patients to bring up anything.

> *"…veer towards areas of things that I couldn't necessarily deal with in a sense…So if someone does start maybe divulging a bit more or talking perhaps in a way that only really someone who is completely trained in CBT to ask those next layers…there was maybe a concern…"*
>
> i-BeST205 (Received face-to-face; face-to-face preference)

Lastly, one online participant questioned whether physiotherapy as a profession should be taking on this realm of patients that require a CB approach, feeling that physiotherapist do have the necessary skills to treat this patient group in a complete sense.

> *"I think my main concern is that I'm not sure where the boundary is…I'm quite happy to have extra skills… but I'm not sure that we've got enough skills to deal with some of these patients in a complete sense…I don't know that it's appropriate that then physio just takes on this sort of realm completely… I'm not sure that it's necessarily quite right."*
>
> Case08 (Received online; no training preference)

8.5.2 Actual experiences of delivering the BeST intervention

Definition: Reflections on or related to participants experiences of actually delivering the BeST intervention

Setting up the BeST intervention

Out of an expected 18 participants, only 12 managed to implement the BeST intervention and deliver the group sessions; from which 9 were interviewed. There appeared to be two main reasons behind this difficulty in implementing the BeST intervention that were experienced by participants in both training groups. The first was constraints in time, with participants finding it difficult to both find the time to set up and organise the group sessions, and to then find the time to identify suitable patients.

> *"…when I was at that site I had no admin staff, so it was me treating my patients and trying alongside that to find people, so I didn't really do that well."*
>
> i-BeST205 (Received face-to-face; face-to-face preference)

> *"I think we're time constrained - that's the biggest thing…we have to get our patients in and out…"*
>
> i-BeST226 (Received online; face-to-face preference)

For those that managed this, the second main barrier to implementation was around patient selection, finding it difficult to firstly identify which patients would be suitable, and secondly, to find enough patients to fill a group. The issues with patient selection tied in with participants' prior concerns around which patients the intervention would be best suited to.

> *"We didn't have enough patients of the right type to put in a group…"*
>
> i-BeST247 (Received face-to-face; face-to-face preference)

> *"I apologise if we don't seem too enthusiastic, it's not through lack of trying, it's the fact that we just can't get our patients…"*
>
> Case05 (Received face-to-face; face-to-face preference)

One participant noted particular difficultly in persuading their colleagues to refer suitable patients to the group sessions, finding that their attitudes were not in line with a psychosocial management to LBP.

> *"…some physios that are very set in their ways, they're stuck in the time warp that they're then not laterally thinking about a holistic approach to patient care, so there's a huge barrier into getting them on board to actually refer into the groups."*
>
> Case05 (Received online; face-to-face preference)

Contrastingly, other therapists appeared to have a supportive working environment, with colleagues showing enthusiasm and a keenness to refer patients to the group.

> *"…they were all happy and positive that we were doing something in trying to help patients with chronic pain which is something that we don't have in the department here…"*
>
> Case07 (Received online; face-to-face preference)

Therapists that did identify suitable patients struggled to get patients to commit to the group sessions. Reasons for this included the time commitment, unavailability due to vacations and not wanting to be part of a group.

> *"…we've had trouble getting patients to come to courses as well, because of the commitment…"*
>
> i-BeST289 (Received online; no training preference)

A further compounding factor in the identification of patients, mentioned by four participants, was competition for the same patient group from both internal and external sources. Three participants (two from the same Trust) reported pre-existing back pain groups that were based on a more biomedical model of health, consisting of some pain education, large exercise components and didactic advice for movement strategies.

> *"We do have our own back clinic that we run once a week…we have an hour with them…talking about pain…then anatomy of the…the dos and don'ts…suggestions of how to do their everyday tasks in a way that's better*

for their back…we go through a series of six exercises…everybody has a little bit of one-to-one contact on doing the exercises…they go away for four weeks…work on the exercise programme and hopefully think of the advice that we've given them… then if they still need some physio, hands on input, we'll then book them in for just the normal routine one-to-one appointment…"

i-BeST197 (Received online; no training preference)

These groups were already in place and required the same patient group, although one participant saw their pre-existing group as almost a progression that patients could be referred to once they had done the six BeST sessions.

"…although we do a bit of CBT vaguely with our Back in Action there's a lot more activity to it… I could see that almost there was a bit of a defining line between them…you might get people who aren't at the stage where they can do the Back in Action and you might get the improvement first time round with helping them manage it a bit better, and then they can do a bit more."

i-BeST205 (Received face-to-face; face-to-face preference)

The fourth participant spoke about competing demands for the patient group from within their Trust and from outside of their Trust. Within their Trust, two clinical psychologists were trying to set up a similar intervention to BeST, although with a more didactic approach. Outside of the Trust, the GPs were working with a separate group of physiotherapists to set up a pain management programme based on the Pain Toolkit.

"…and then out in the community, the commissioners, the Pain Clinic and the GPs are trying to set up with pain tool kit…targeting similar groups so…there's lots of things going…and we've got this other thing that is TICKS which is that, when we went out to tender for our jobs, TICKS got a lot of the work with GP's and they've got TICKS physio's in clinics…and this tool that they're going to use…with these TICKS physio's, not us so..."

i-BeST226 (Received online; face-to-face preference)

Therefore, whilst managing to recruit patients with difficulty, they felt that that their chronic pain service was very fragmented with the same patients in demand by several groups of health care providers.

Two participants spoke about factors that drove the implementation of the BeST intervention. For one face-to-face participant, there therapy manager was a driving force, supporting and motivating the participant to deliver the intervention.

> *"…it wasn't until Anon was really insistent and like, "Come on sort this out"…"*
>
> i-BeST205 (Received face-to-face; face-to-face preference)

For the other participant, they spoke about the trial competency assessment as a driver for implementation, saying that without the pressure to deliver the intervention for the competency assessment, they might never have got around to organising it.

> *"…it's probably good that we've had these things looming over us because it's kept us up to date… because we know that you're going to come and watch us do it, it's sort of made us do it, which is good…it's quite easy just to have not bothered."*
>
> Case05 (Received online; face-to-face preference)

Whilst at the time of the interview, the participant was scheduled to deliver the groups, unfortunately, due to a lack of patients, the groups had to be cancelled.

Delivering the BeST intervention

Online participants

One therapist was interviewed prior to delivering the groups who had commenced the patient assessments. They felt that they had improved at conducting the assessment and in their skill of goal setting, which was something they were previously anxious about.

> *"…don't really feel confident doing the assessment because it's so different, so actually I'm feeling I'm more better at that now."*
>
> i-BeST289 (Received online; no training preference)

They found it interesting to see patients' responses when they took more of a back seat and gave the patients more control, for example, in selecting their own exercises. They also reported that patients had been quite positive about the intervention when it was described to them.

> *"They'll choose a really easy one in one thing, and the hardest one of another thing. I found it quite interesting watching what they'd choose."*
>
> i-BeST289 (Received online; no training preference)

Three online participants had delivered group sessions at the time of the interview, two of which, had positive reflections on their experience. One participant explicitly stated that they had enjoyed doing the groups.

> *"I mean the classes that I've done, so I've done two, yes, I've quite enjoyed doing them…"*
>
> Case08 (Received online; no training preference)

For one participant, the positive reactions from the patients appeared to have influenced the therapist's attitudes and behaviour regarding aspects of the course.

> *"…that group really like the ...the map...the brain and there's one or two of them that have really ... they love that idea and…I actually brought a picture into that session from the explain pain book so they could look at that...you know the homunculus man stuff and some of them were really fascinated by that and I thought, I must bring that in more in everyday practice I think."*
>
> i-BeST337 (Received online; face-to-face preference)

One therapist's prior concerns about group dynamics did not materialise, feeling that their group was very good. They also noted that patients did not have any problems understanding the content, which they were previously worried about. They found that the time went quickly and that they need not have worried about filling the session.

> *"…they were quite good. They seemed to be able to understand it…"*
>
> i-BeST337 (Received online; face-to-face preference) – in reference to session three

"…although when you're actually doing it the time does go incredibly quickly because when I first looked at it I thought, "Oh how am I going to spin that out over an hour and a half?" But it does seem to work out time wise."

i-BeST337 (Received online; face-to-face preference)

Only one participant had received feedback on their competency assessment at the time of the interview. They reported finding this feedback very useful and were grateful to have received it.

"I was grateful for the feedback…So that really helped…that's been really, really useful for me..."

Case08 (Received online; no training preference)

Two online therapists, from the same Trust, were delivering alternate sessions of the BeST intervention to the same cohort of patients. They struggled with patient compliance as the group progressed, beginning with five patients, which dropped down to two patients after the first session, with no patients turning up to session five (they had not yet run session six). The therapists felt this could be due to a number of factors, including the inclusion of inappropriate patients, the commitment of six sessions being too much for the patients and also the time of the sessions. Due to organisational issues within their department, they had to run the groups at 8am on a Thursday morning, which they felt may not have been ideal for this patient group.

"…in the end it was Thursday morning, which I don't necessarily think first thing on any morning is good for these kind of patients….individuals don't really want to get up that early…Or (if) they do get up that early, they don't want to be moving around too fast in getting to the physio department."

Case08 (Received online; no training preference)

Due to the small numbers in their group sessions, one participant struggled to facilitate the group. They had initially thought the patients would be shy and would need to be prompted; however, they found that the opposite was true and thus found it difficult to direct and guide the conversation.

"…when they were really engaging with the conversation, the discussions, I felt it difficult sometimes to guide them and sort of decide okay, so we have to stop the discussion here now and then we're going to move on to this one here. ..Before the group started, I thought well maybe they're going to be shy, I'm going to have to try to get them on board…and it was the opposite."

Case07 (Received online; face-to-face preference)

Having now got some experience at running the groups, they felt they would be able to better identify appropriate patients and that they could use a much broader selection criteria.

"…during the group then I changed my mind. I thought we can open this to many more patients really."

Case07 (Received online; face-to-face preference)

On the whole, the main difficulty for participants was an uncertainty about when to close down discussions and move the session forward, although therapists noted that patients appeared to enjoy the discussions they had amongst themselves.

"...they kind of get off the subject…and you kind of think, you know, should I step in a bit quicker and bring them back to what we're doing…then you think, well it's good for them to talk and amongst themselves really."

i-BeST337 (Received online; face-to-face preference)

Face to face participants

Only one face-to-face participant had delivered the BeST intervention at the time of the interview and they had completed all six group sessions. They described their experience of running the groups as good and were surprised by the effectiveness of the BeST intervention with their patients.

"Yeah really good actually… yeah I found it not easy but not actually that daunting once I got into it."

i-BeST205 (Received face-to-face; face-to-face preference)

Similarly to one of the online participants, their prior concerns about group dynamics did not materialise.

"They were a really good group, like they just seemed to get on and even though they had differing levels of discomfort at the beginning and it varied differently, they still managed to get on pretty well…"

i-BeST205 (Received face-to-face; face-to-face preference)

Additionally, they noted that they did not need to worry if patients bought up topics that were out of their scope to deal with, finding that actually, patients would talk amongst themselves if these issues arose.

"…even though there were times where I did wonder maybe someone was starting to veer towards areas of things that I couldn't necessarily deal with in a sense, usually they would talk about it amongst themselves in a way and actually that's really something that we've always I suppose said or found with research about group type activities, the benefits that we know with that. It was really good."

i-BeST205 (Received face-to-face; face-to-face preference)

This participant described a conscious effort to stay in a CB mind-set, trying to avoid bringing in their own opinions related to physiotherapy.

"…trying to stick to how I felt I understood it and what had been taught, whilst as I say trying not to bring in too much of my own understanding or thoughts if they were actually not helpful to really staying true to the CBT type stuff."

i-BeST205 (Received face-to-face; face-to-face preference)

Thus suggesting that they viewed the two strands of treatments as discrete separate treatment paths, as opposed to an interlinked and complimentary pathway.

"…trying not to veer too much down the physio route as well and start talking about exercise and talking …too much from my opinion, but actually keeping it on the track of what I should be encouraging from the CBT route."

i-BeST205 (Received face-to-face; face-to-face preference)

Whilst not directly described by any of the online participants, this divide between physiotherapy and a CB approach was also hinted on by an online therapist. They found it

difficult to stick to the programme of discussion and talking, wanting to fill a section of that time with group based exercises.

> *"I know there's the chance to look at people's exercise and some weeks they say, "Oh can you check this particular exercise," …but there's just that overwhelming urge to think, wouldn't it be nice to have 20 minutes where we all did a bit of jogging exercise together…"*
>
> i-BeST337 (Received online; face-to-face preference)

This could infer some tension between the perceived CB and physiotherapy approaches, suggesting that a therapist can only follow one or the other, with therapists finding it difficult to hold back their 'physiotherapy approach' when in the 'CB approach'.

8.5.3 Thoughts on future implementation

Definition: Participants' thoughts relating to the future implementation of BeST and future training with i-BeST.

Future implementation of online training for the BeST intervention

Both online and face-to-face participants were asked about the future implementation of i-BeST to train therapists in the BeST intervention. Ten of the twelve participants that responded felt that the online training would fit into an NHS outpatient environment providing they had managerial support that allowed the time during work to complete it.

> *"…as long as your manager gives you time to do it, and I think chunks of time so half an hour here and there isn't worth while then I can't see why not…"*
>
> i-BeST258 (Received online; face-to-face preference)

For those in the online group who had experienced technical difficulties, this was also dependent on resolving technical issues, sorting out the costs of printing materials and, for one participant, finding a method of 'policing' the training, to ensure people would do it.

> *"I think providing the links, because different hospitals will have different restrictions, so if it all sort of came on a thing, a programme or something like that, I think it would be all right."*

i-BeST289 (Received online; no training preference)

"…it depends doesn't it whether people would do it at home - or whatever, it's policing that I guess, isn't it? In a bigger set up…"

i-BeST226 (Received online; face-to-face preference)

Two online therapists did not think the online training programme would suit an NHS outpatient environment. For one participant, this was due to time constraints and waiting list demands, and for the other participant, this was due to not being able to learn the practical application of skills adequately enough with online methods.

"Not particularly well, no, because it's all about ... I think the target in the NHS these days is all about number crunching."

i-BeST337 (Received online; face-to-face preference)

"I do for theoretical knowledge. But I don't for practical knowledge, no. There's no substitute for practicing."

Case08 (Received online; no training preference)

Participants in both groups felt that some form of follow-up support after completion of the online training would be beneficial. They felt that this could be through a variety of methods, including a telephone consult, and did not feel that it necessarily had to be with the tutor.

"I think if I had a number to call, I could have called them…if you have any questions, those that may need to, can do so. Like me."

i-BeST208 (Received online; face-to-face preference)

"I think if you've done on-line…it would be nice to have someone just either check you doing the class or just to reassure you that you are actually doing it correctly...I think unless it's anything serious, a phone is surprisingly good actually, or even not necessarily with the tutor, but somebody who's already done it…a support network of some sort."

i-BeST247 (Received face-to-face; face-to-face preference)

Future implementation of the BeST intervention

Participants in both groups identified that there was a clinical need for this type of intervention and felt that it should be implemented in NHS Hospital Trusts.

> *"…it's something that needs to be set up across the Trusts…It's just Psychology Services are so limited and have never been able to have access to it…"*
>
> Case05 (Received online; face-to-face preference)

> *"…we have lots of patients that probably don't need conventional physio really anymore and they need a different approach."*
>
> Case08 (Received online; no training preference)

One participant noted that a number of sources were establishing similar interventions that may compete against each other.

> *"But I am aware that it is happening in different Trusts, you know, talking around people are doing this and it has been coming on for a long, long time."*
>
> Case05 (Received online; face-to-face preference)

Regarding future implementation of the BeST intervention itself, two online participants hypothesised that they would modify the intervention to potentially reduce the number of sessions, aiding patient commitment, and add in more exercise components.

> *"I think we have sort of designs to just condense it a little bit and add a bit more exercise component into it, but we'll have to see how the patients find it really…"*
>
> Case05 (Received online; face-to-face preference)

> *"I think we might have to modify it because it was hard to get people to attend…"*
>
> Case08 (Received online; no training preference)

For three participants, the evidence base behind the intervention was a driving force to implement it and they felt this would play an important role when considering future implementation on a wider scale.

"…more and more research coming out, it's not just about what you do, it's the way that you manage it, I think it's – obviously the actual program itself has been fairly well validated, hasn't it, from the research…"

i-BeST257 (Received online; online preference)

"I think what I did was sent those two articles round to key people in each area and got this barrage of wow, this is really good, this is interesting, yes, this is great, great, so yes…everybody wants to do it…"

i-BeST226 (Received online; face-to-face preference)

Two participants specified the need allow an initial outlay of time to invest in the set-up of the group sessions, saying that, without the necessary available time, it would be difficult to for them to implement BeST.

"…once you're aware of how much time it's going to take up and you can sort out your patients in plenty of time and make sure you've got the right numbers and the right patients then it would be a good thing to run and to keep running if it was successful."

i-BeST243 (Received online; face-to-face preference)

8.6 Theme five: experiences of study processes

Definition: Perceptions of study related processes and experiences of being in a study (RCT or case series).

All participants were happy with the information they received prior to taking part in the study.

> *"It all seemed quite clear and everything really yes…"*
>
> i-BeST257 (Received online; online preference)

> *"I knew where I was going, knew what to expect, felt that I was fully informed and set up for knowing that I could withdraw and it was all fine."*
>
> i-BeST205 (Received face-to-face; face-to-face preference)

Reasons for taking part mostly included an interest in CBT, wanting to develop their clinical skills, to gain access to the BeST information, and to improve their/their department's management of chronic pain patients.

> *"I had heard bits and pieces…a few years ago and this is a term that gets banded around, oh so you need a cognitive behaviour approach but nobody really explains very clearly what that was; so it's quite interesting in getting involved in it."*
>
> i-BeST257 (Received online; online preference)

> *"…an opportunity to develop my skills and improve my knowledge of clinical capacity."*
>
> Case07 (Received online; face-to-face preference)

Four participants felt their experience in the trial was as expected, with two participants saying it had exceeded their expectations.

> *"Yeah, maybe as I say better than I expected…"*
>
> i-BeST205 (Received face-to-face; face-to-face preference)

> *"It's been really good so I'm really pleased to have been part of it…"*
>
> Case05 (Received online; face-to-face preference)

One participant did not have any prior expectation and therefore did not know what to expect. One participant thought that there would be more background on CBT in the training, that aside, they felt as though it met their expectations. Four participants had not realised that the trial involved the implementation of the BeST intervention. Therefore, their experience was not what they had initially expected.

> *"My understanding was really that you were looking purely at the difference between online training and face to face training, just off the actual course material as opposed to then going on to doing the patient contact part…"*
>
> i-BeST197 (Received online; no training preference)

This tied in with an issue that emerged from the data around obtaining postal consent. All participants signed a consent form detailing that they had read and understood the participant information sheet, and yet some participants did not realise the details of the study until much later.

> *"The truth was we thought we were signing up for a chronic pain course…Anon said, "You do realise that you're part of a research trial and that you're going to be allocated?"...so we didn't know…"*
>
> i-BeST226 (Received online; face-to-face preference)

When probed about this, participants felt as though they must have skimmed the information sheet and not clearly read the details, thinking that they were signing up for a training course. This highlights a large disadvantage of gaining postal consent.

> *"Initially I didn't probably quite – probably didn't read it quite properly! Initially I didn't quite understand that's what it was and then obviously I realised later on and yes, it was pretty much as I expected it to be."*
>
> i-BeST257 (Received online; online preference)

All barring one participant were happy with the outcome measures used in the study, although they were all nervous about having a group session audio recorded.

"…it was free cognitive behaviour therapy training, "Oh yes, we'll all do it," but somebody from the university will be coming out to tape you…And people like thought, "Oh no, I can't do that, that's too stressful"…"

i-BeST337 (Received online; face-to-face preference)

One participant did not like the post training knowledge test, finding the questions too theoretical and not applicable to their clinical practice.

"I found some of the questions like how many factors are there in CBT… or whatever, some of those a bit – I'm not sure how applicable they were to actually doing it in practice…"

i-BeST257 (Received online; online preference)

Nine participants felt that their colleagues were positively interested in the trial or in the BeST intervention, although they think it would have had a greater impact had they accessed the training at work.

"I think what I did was sent those two articles round to key people in each area and got this barrage of wow…"

i-BeST226 (Received online; face-to-face preference) – regarding interested colleagues

"I think another one or two colleagues would have liked to have done it, but weren't able to, and therefore I think the on-line would have been great for them, because they could have probably done it in their own time, if it was available…"

i-BeST337 (Received online; face-to-face preference) – regarding interested colleagues

Three participants asked if the training would be run again or if they could give their colleagues access to the online training programme.

"Are you running another? Can we send our staff as well?"

i-BeST226 (Received online; face-to-face preference)

"…it would be nice to have kept that on like a DVD or something for us to go back to in future, and certainly if we're going to recruit more staff to do it, as juniors rotate round…"

Case05 (Received online; face-to-face preference)

Chapter 9 – Discussion

This chapter will discuss:

1) The interpretation of results from a mixed methods perspective, including the strengths and weaknesses of each study.
2) The findings in relation to the wider literature.
3) Methodological issues in relation to the mixed methods study.

9.1 Interpretation of results

This study explored two implementation strategies (online and face-to-face training) for the BeST intervention using both quantitative and qualitative methods. Overall, this evaluation did not find large differences between the two groups in relation to participants' clinical competency and knowledge, although the level of uncertainty is wide reflecting the relatively small sample size. The face-to-face training appeared to be superior for producing changes in attitudes and beliefs about LBP. In terms of satisfaction, while neither group were dissatisfied with the training method, the face-to-face training participants reported greater satisfaction. Importantly, both methods had a poor impact on the delivery of the formal group-structured BeST intervention in clinical practice, with just over one third of all physiotherapists implementing the BeST classes. These quantitative findings are discussed below and are integrated with the qualitative findings.

9.1.1 Findings relating to therapist competency after training (Outcome at level three in Kirkpatrick's (62) training evaluation model)

The post-training clinical competency of the physiotherapists was similar across both groups. Unfortunately, due to the small number of therapists implementing the BeST intervention, it was not possible to estimate the effect of the intervention on clinical competency with great precision (160). The confidence interval around the mean difference suggested that there was not a large, nor clinically important, difference between both groups, with the mean difference falling somewhere between -0.3 points

(favours online) to 0.54 points (favours face-to-face). However, due to imprecision in the estimate of effect, it was not possible to draw any further conclusions regarding the effect of the training methods on participants' clinical competency (168).

The descriptive analyses showed that groups demonstrated higher competency on items that were more closely related to their usual clinical practice, or that reflected more generic therapeutic skills, such as interpersonal effectiveness. Individual mean competency scores ranged from 1.64 to 2.5 on the 6-point scale, indicating that therapists achieved a status of novice or advanced beginner according to the CTS-R-Pain classification scale. These competency scores would be expected to improve with practice and, given that this was the first time therapists had delivered the BeST intervention, reflect promising levels of competency in line with current experience.

Interpretation of the CTS-R-Pain competency scores within the wider literature

The CTS-R-Pain is a newly developed tool to assess clinical competency in using a CB approach and as yet, no definitive work has been conducted to establish what CTS-R-Pain score would reflect clinical competency. However, the tool was used to assess the competency of health care professionals in the original BeST trial (142). Eleven therapists were assessed at one or more time points, giving a total of seventeen observations with a mean CTS-R-Pain score of 2.7 on the 6-point scale, indicating a status of advanced beginner. These health care professionals delivered the BeST intervention to patients in the BeST trial, where the intervention was found to be clinically and cost-effective (14). Thus suggesting that a mean score of 2.7, which was not dissimilar to participants in this thesis, represents a sufficient degree of clinical competency to positively influence patient outcomes.

On the other hand, this mean score could question the importance of clinical competency when delivering manualised treatment interventions, such as BeST. Manualised CB

approaches are thought to require less skill and training to deliver (42). In an exploration of this, Hansen (139) conducted a regression analysis on a sub-sample of therapists (n=9; 17 groups) and patients (n=136) in the original BeST trial and found that therapist competence explained only 1% of variation in patient outcome measures. However, it is not unusual to find a lack of relationship between competency and clinical outcomes within the context of a clinical trial (169). There are various confounding and methodical variables that could prevent the detection of a competency effect, such as the relatively tight range of recorded competency scores limiting inferences with patient outcomes (139). Additionally, since any effect of competency is likely to be small, RCTs are often underpowered to detect such effects in sub-group analyses (76). Nonetheless, Hansen (139) postulated that the clinical competency of individual therapists may not significantly affect the clinical effectiveness of this manualised treatment intervention.

Thus, it is difficult to interpret the competency scores of the participants in this thesis beyond the following observations:

- Clinical competency scores were very similar in both groups.
- The levels of competency achieved by participants were in line with expectations given the short training programme that the participants received.
- Mean competency scores from participants in this thesis were similar to those recorded from therapists in the original BeST trial, where the intervention was found to be effective.

Integration with qualitative findings

The qualitative thematic analysis highlighted considerable anxiety among participants from both groups regarding the verbalisation of concepts, the use of an exploratory questioning style, and facilitation of the group with a discursive style. These anxieties were exacerbated for online participants who were sceptical that they had learnt these skills proficiently

through the online medium, without access to peer interaction, practice, and feedback. Interestingly, the median scores for the items that best capture these skills (items 3 and 9) were identical for both groups, with the mean scores slightly favouring the online group. Thus, despite their anxieties, it would appear that the online participants in this sample performed these skills (exploring questions and use of a discursive facilitation style) at a similar level to the face-to-face participants.

Participants in both groups found it difficult to grasp and apply some of the more cognitive behavioural content, particularly around thoughts and feelings, and challenging negative thoughts. This is perhaps not surprising given the dominance of the biomedical approach within physiotherapy practice and the shift in paradigm required to learn and apply these CB skills (20). Additionally, the influence of supervision on clinical competency should be considered. Supervision is integral within the psychology profession and has been defined as:

> *'An intervention provided by a more senior member of a profession to more junior member or members of that same profession. This relationship is evaluative, extends over time, and has the simultaneous purposes of enhancing the professional functioning of the more junior person(s), monitoring the quality of professional services offered to the client, she, he or they see, and serving as a gatekeeper of those who are to enter the particular profession.'* (170) (p775)

Research in the field of CBT training suggests that workshops and manuals may be best supplemented by supervision, which, as the definition suggests, should be provided by an individual deemed at least competent in the intervention/treatment (43, 44). The online forum (available separately in both training arms) provided an avenue for participant support and supervision; however, since it was not used, participants did not receive supervision through this. The other opportunity to receive supervision was from the

observation and audio recording of a group session. Due to the low implementation rate, a large proportion of therapists did not receive this clinical supervision, which may have made it harder for them to learn and apply these new CB skills.

Factors that may have influenced CTS-R-Pain competency scores

Due to practical constraints, the RCT recruited multiple participants from single sites. The qualitative interviews showed that many of these participants collaborated with their peers who received the other form of training, which may have resulted in contamination of the training effect. Another potential confounding influence may have stemmed from contact with the lead researcher during the interviews. Participants interviewed prior to their assessment of competency would have had the opportunity to ask questions and clarify points. Since more online participants were interviewed, this may have confounded competency scores in the online group.

Additionally, only one treatment session was recorded for each participant who delivered the BeST intervention. This single recording may not have provided an accurate reflection of the therapists' competence across all six of the group sessions. Previous evidence suggests that therapist competency improves over time with practice, suggesting a learning effect (171, 172). Therefore, it is possible that assessments of competency from earlier group sessions may not have reflected competency after completing all six sessions. However, the majority of assessments fell in the middle third of the six group sessions, with half of the assessments drawn from a recording of session three.

Lastly, due to time and limited resources, some participants working within the same NHS Trust had to deliver the BeST intervention jointly, alternating their group sessions. This may have also influenced their competency assessment by both reducing the number of sessions they ran and potentially affecting their rapport with the patients. However, this is

reflective of the real world and occurred for participants in both groups. Thus, it was unlikely to have affected one group over the other.

9.1.2 Findings regarding physiotherapists' attitudes and beliefs towards the management of persistent LBP

(Outcome at level two in Kirkpatrick's (62) training evaluation model)

PABS-PT Factor One – biomedical attitudes and beliefs towards persistent LBP patients

The face-to-face group showed a greater reduction in their biomedical attitudes and beliefs towards the management of chronic LBP patients that was statistically significant, suggesting that the online intervention was not sufficient on this variable. When looking to interpret the mean change score observed in the face-to-face group, there is no guidance or consensus in the literature to suggest what constitutes either a clinically meaningful change in attitude, or what score signifies a 'biomedical' or 'psychosocial' orientation towards chronic LBP patients (143).

Drawing on the literature

The face-to-face group mean change in PABS-PT factor one score observed in this thesis aligns with the mean change scores observed in other studies investigating educational interventions. Overmeer et al (173) reported a decrease in physical therapists biomedical attitudes and beliefs by 8.1 points following an eight-day university based training course in the identification and management of psychosocial risk factors for LBP. In a shorter training programme, Vonk et al (174) found that physiotherapists reduced their biomedical attitudes by a mean of 4.4 points, 3 months after a 2-day behavioural graded activity training course. Thus the mean change in factor one score observed in the present study in is line with reported changes in the literature, although interestingly it better reflects the changes observed from the more intensive (8 day) training programme used by Overmeer et al (173). However, these studies still do not provide any guidance to suggest whether these changes resulted in any real clinical impact.

In an extension to their earlier study, Overmeer et al (175) recorded outcome measures for the patients who were being treated by the physical therapists in their RCT. Despite recording a mean reduction in biomedical attitudes and beliefs of 8.1 points among the trained physical therapists, they found no difference in patient outcomes between those treated by the physical therapists who had attended the training course, compared to those treated by untrained physical therapists. This suggests that a mean change in factor one score of 8.1 points, observed in Overmeer et al (175) and in this thesis, may not be clinically meaningful in relation to patient outcomes.

However, study limitations may account for their absence of significant findings, including a lack of specificity of the training, no measure of clinical practice behaviour and a lack of power to detect training effects through patient outcome measures. Additionally, behaviour change is complex and dependent on multiple factors, with attitudes and beliefs identified as an important component in many theories of behaviour change (176). Based on these theories, either the observed change in factor one score was not large enough to result in improved patient outcomes, or a lack of effect was not detected in the study due to methodological limitations. Overall, there is insufficient evidence in the literature to determine whether the mean change in factor one score observed in the face-to-face group in this thesis is clinically meaningful.

Integration with qualitative findings

Despite the lack of guidance in the literature, data from the qualitative interviews provided insight into how physiotherapists' attitudes and beliefs impacted on their clinical practice. Participants in the online training group described attitudes and beliefs towards their management of persistent LBP patients that were more reflective of a biomedical orientation, complementing the quantitative results. One therapist indicated that they were starting to shift their attitudes after delivering a number of the BeST group sessions, suggesting a continuation of learning outside of the training course. Whilst the small

number of face-to-face participants that were interviewed prevents any contrasts from being draw, those that were interviewed described changes that were reflective of a reduced biomedical orientation. This complementary finding could imply that the observed decrease in biomedical attitudes and beliefs for face-to-face participants may reflect real, clinically important changes to their management of persistent LBP patients. Importantly, this inference is purely speculative due to the small number of face-to-face participants that were interviewed (115).

Factors that may have influenced the observed PABS-PT scores

One consideration is the differing times at which the PABS-PT was completed. Face-to-face participants completed the questionnaire immediately following their training, before they left the room. Online participants were asked to complete the questionnaires immediately following their training, though in reality the questionnaires were often sent back a few weeks after course completion. The time lapse between finishing the training and completing the PABS-PT questionnaire may have resulted in some dilution of the training effects. However, the aim of the training was not to achieve short temporary shifts in attitudes and beliefs, and thus, any long lasting change should have been detectable despite the varying time points.

Another consideration for the lack of change in attitudes and beliefs is the degree of engagement the participants had with the course. The thematic analysis identified several barriers to online learning that affected the concentration of learners. When the results were stratified according to degree of engagement, participants classified as more engaged had a greater decrease in mean factor one score. However, the mean change was still small when compared to the face-to-face training group, suggesting that there were other factors influencing attitude change. Online participants attributed enthusiasm (from oneself or the tutor) and social influence as important factors for achieving attitude change, which they felt would have been greater during face-to-face training.

Literature pertaining to the process of attitude change

Research into the creation, maintenance and change of attitudes is vast and has occupied much of the social psychology field over the past century (177). The process of attitude change is known to be complex and an abundance of models and theories have been postulated to explain these multifaceted processes (177). Whilst it is outside the scope of this thesis to review these theories and models here, taking a more superficial glance at the literature can provide some insight into why online participants may not have reported the same degree of attitude change.

One widely acknowledged process of achieving attitude change is through cognitive dissonance, whereby an individual behaves in a contradictory manner to their attitudes and beliefs, resulting in mental conflict and emotional discomfort (178). More recently, cognitive dissonance has also been shown to occur when an individual observes the actions of others that do not fit with their own attitudes and beliefs (179, 180). Therefore, participants in the face-to-face group may have experienced cognitive dissonance from the attitudes and beliefs of their peers (in addition to the tutor), resulting in attitude change to resolve the mental conflict. Online participants would not have been exposed to cognitive dissonance from peers.

Additionally, affective states (emotion) have been shown to exert a significant influence on attitude change (177). Thus, it is possible that extraneous variables influencing a participant's mood, such as the tutors enthusiasm or allocation to their preferred training arm, may have indirectly influenced the readiness of participants to change their attitudes. This is further supported when considering participant motivation, which is known to be a key component of attitude change (181). As the qualitative analysis revealed, many participants were sceptical about learning BeST online and/or had a preference for face-to-face training. Thus their motivation to learn, engage with, and change their attitudes may have been low.

Lastly, many theories of attitude change suggest that individuals consider a number of factors about a message they have heard, before that message results in attitude change. A key factor evaluated by the individual is the evidence base behind the message (182). Whilst the content of the training arms was identical, it is possible that the tutor in the face-to-face training further validated messages with responses to questions or by providing additional anecdotal evidence to add further substantiation.

PABS-PT Factor Two – psychosocial attitudes and beliefs towards persistent LBP patients

Only the face-to-face group showed a positive mean change in reported psychosocial attitudes and beliefs, and the observed difference between groups was much smaller.

Drawing on the literature

This trend appears consistent with the literature, looking again to Overmeer et al (173), who reported a mean change in psychosocial attitudes and beliefs of 2.1 points, and to Vonk et al (174) who did not find any change in score on the psychosocial factor. A recent systematic review investigating the measurement properties of the PABS-PT found that factor one, reflecting biomedical attitudes and beliefs, was more robust than the psychosocial attitudes and beliefs measure, factor two (143). They postulated two explanations for the relative instability of the psychosocial factor: that the psychosocial approach was more elaborate than the biomedical approach, and that the two approaches may not be opposites on the same scale (143). Therefore, it may not be surprising that in the present study, only small changes in factor two were observed, since it may not be as sensitive to change or as reliable as factor one.

9.1.3 Findings relating to participants' self-efficacy to deliver the BeST intervention (Outcome at level two in Kirkpatrick's (62) training evaluation model)

Self-efficacy – BeST patient assessment

Face-to-face participants reported greater self-confidence to perform the BeST patient assessment compared to online participants.

Integration with qualitative findings

The thematic analysis complimented this quantitative finding and also reflected a lack of confidence amongst online participants regarding the patient assessment. Online participants felt that the assessment was very different from their usual physiotherapy assessment and this difference was a cause of particular anxiety. They also felt that the assessment was not adequate for new patients since it did not cover important screening questions to rule out potential emergencies, and were concerned about covering all the content within the department's time constraints. Since all of these factors would have been applicable to the face-to-face participants, it is interesting to contemplate why these anxieties were reported solely among online participants. Both groups were trained using identical content, excluding teaching materials as an extraneous variable. A potential explanation for this finding could be that the face-to-face participants entered into a discussion with their peers/the tutor during their training about any anxieties or questions that they may have had regarding the assessment. Since the online participants did not use the online forum, they may not have discussed their concerns or anxieties during their training.

Self-efficacy – BeST group sessions

Despite the difference in reported confidence to perform the BeST assessment, both groups reported a similar level of confidence to deliver the BeST group sessions.

Integration with qualitative findings

The thematic analysis revealed anxieties about delivering the BeST group sessions in both online and face-to-face participants, supporting the proximity in group mean scores quantitative scores. Both groups of participants were anxious about verbalising unfamiliar concepts, particularly in relation to session three on thoughts and feelings. They were also concerned that using exploring questions could lead to topics/issues outside the scope of their practice and that they would place further strain on limited time. Online participants

voiced additional concerns prior to delivering the BeST intervention including delivering the groups with a discursive style, managing group dynamics, patient attendance, and adherence to the session narratives. However, only two face-to-face participants were interviewed, compared to eleven online participants. Similar anxieties may have been found had the sample included a greater number of face-to-face participants.

Factor that may have influenced self-efficacy scores

Discussing the groups separately, online participants were more confident to deliver the group sessions as opposed to the patient assessment. This could be due a number of factors. Firstly, the session narratives provided scripted detail of each session which may have provided the therapists with more confidence to deliver the content. Secondly, the thematic analysis revealed that online participants placed great value in the session videos, enabling them to see the group sessions put into practice. The provision of clinical material demonstrating the intervention through realistic role-plays has been identified as a critically important training component of online courses (183). Therefore, having access to video examples of the group sessions may have resulted in greater confidence to deliver them. Lastly, therapists were familiar with some of the group session topics, such as pain education. This may have increased their self-efficacy to deliver the group sessions in comparison to the assessment.

9.1.4 Findings relating to participants' post-training knowledge of the BeST intervention (outcome at level two in Kirkpatrick's (62) training evaluation model)

Post-training knowledge scores were high in both groups. Based on the high scores observed from participants in the online group, it appears that i-BeST can provide participants with a good understanding (knowledge base) of the BeST intervention. However, there are several factors to take into consideration. Firstly, qualitative data indicated that online participants may have completed the knowledge tests using the training manual or their notes, thereby giving them an advantage over the face-to-face

participants. Secondly, the knowledge test was created for the sole purpose of this study and therefore the validity and reliability of the test is not known. Thus it is not possible to deduce how accurately the test scores reflect actual knowledge of the BeST intervention. However, the scores show promise in the potential to influence knowledge with the online intervention, i-BeST.

Integration with qualitative findings

Despite the lack of validity and reliability for the post-training knowledge test, qualitative data suggests confirmatory evidence that participants from both groups improved their knowledge as a result of the training they had received. Several therapists provided specific examples of how they had applied this new knowledge to their clinical practice, without prompting from the interviewer. Thereby suggesting that participants in both groups did achieve changes in knowledge that influenced their clinical practice as a result of their training.

9.1.5 Finding relating to participants' reactions to the training (outcomes at level one in Kirkpatrick's (62) training evaluation model)

Satisfaction

Whilst eleven of the fifteen online participants were satisfied with their training, those in the face-to-face group were significantly more satisfied with the training they received. Satisfaction was found to be higher among participants who were allocated to their training preference or who had no training preference in both groups.

Integration with qualitative findings

Findings from the thematic analysis revealed participant preference to be multifaceted with strong links to past experience and learning style. Thus, it may not be surprising that, even in response to a positive training experience, participants still rated greater satisfaction when they felt the training was best matched to their perceived learning style. Participants that were either 'unsatisfied' or 'neither satisfied nor dissatisfied', felt happy with the content of the training, with their uncertainty or dissatisfaction lying with the medium of course delivery. These participants repeatedly cited that they missed the social interaction and opportunity to verbalise and practice new skills, and therefore would have preferred the face-to-face training. This links in well with Laurillards Conversational Framework (184), which stipulates that learners learn though an interactive dialogue with others in order to clarify understanding and obtain feedback on performance. Complimentary to this, Wong et al (59) identified the important influence of the availability of non-internet alternatives that learners could perceive as more desirable. Since participants knew the training was also being delivered in a face-to-face format, they may have perceived this to be more advantageous, reducing their satisfaction with the online training (59, 185). Should participants have only had the option for online training, their self-reported satisfaction may have been different.

Additionally, participants identified a number of intrinsic and extrinsic barriers to online learning during the course which may account for the lower satisfaction ratings. Key intrinsic barriers were concentration and discipline, which linked to the external barriers of environment, technical problems and time. Technical problems and issues around time relating to self-management are widely cited barriers to online learning (78, 186, 187). However, this thematic analysis identified additional barriers to online learning that have not been frequently referenced in the literature. In particular, the improved flexibility of learning, cited as an advantage to online learning (177), proved to be more problematic than advantageous for the physiotherapists in the context of this study.

Engagement with the online course

Leaner analytics highlighted different degrees of engagement with i-BeST and identified a number of participants from the Heart of England NHS Foundation Trust that did not complete the online course. The majority of participants from this site were also classified as being among the least engaged. This could be explained by the findings of a realist systematic review that explored Internet-based medical education (59). The review found that users needed a good reason to engage in an online course, without which, outcomes were less favourable. Since participants from this site would not be implementing the BeST intervention, they may have lacked a good enough reason to engage with the course.

No participants used the online forum, which is interesting given the emphasis placed on the importance of social interaction in the design of online courses (53, 83, 188).

Integration with qualitative data

Many of the interviewed online participants were surprised by how much they engaged with the online programme, finding the content interesting and very relevant to their clinical practice. Interestingly, online participants randomised against their preference had higher mean scores for all outcome measures excluding satisfaction. This suggests that

these participants engaged well with the programme, which could imply that their perceptions regarding their own learning style were not accurate. It may also reflect an initial resilience to change, a theme identified from the thematic analysis and cited in the literature as a barrier to online learning (186).

Participants identified a number of factors that deterred them from using the online forum ranging from anxiety around posting a question to a lack of need to use it. This latter finding is in agreement with a recent survey of health professionals' online learning preferences, which identified little or no interest to be put in contact with concurrent online learners (183). Negative past experiences were also a deterrent which could be explained with the theory of planned behaviour (TPB, (189)). In the TPB, past experience is a construct within perceived behavioural control and is thought to influence behavioural intention (176). Participant anxiety around using the forum also links in well with the TPB, where self-efficacy forms a key component of behavioural intention and ultimately actual behaviour.

9.1.6 Findings relating to the number of participants delivering the BeST intervention (outcome at level three in Kirkpatrick's (62) training evaluation model)

Overall, implementation of the BeST intervention was low, with a 39% implementation rate. Implementation rate was similar across both groups, with seven and five therapists delivering the intervention in the face-to-face and online groups respectively. Stratifying the results showed that participants delivering the BeST intervention had superior scores for all outcome measures. On the whole these differences were small, suggesting that additional factors may have influenced the implementation of BeST. Interestingly, participants implementing the intervention had a lower group mean for biomedical attitudes and beliefs and a higher group mean for psychosocial attitudes and beliefs towards the management of LBP patients. Thus suggesting that therapist attitudes and

beliefs may have been predictive of a clinician's decision to implement BeST into their clinical practice. This is supported by the literature, where the attitudes and beliefs of health care professionals have been shown to directly influence their choice of treatment with patients (190), and their use of clinical guidelines (191).

Factors that may have influenced implementation of the BeST intervention

When considering the processes involved in the implementation of evidence, the majority of implementation models and theories emphasise the integration of multiple components in order to achieve successful implementation (24, 192). Damschroder et al (32) produced the Consolidated Framework for Implementation Research (CFIR) in an effort to consolidate the theoretical implementation literature. They identified five key domains integral to implementation (the intervention to be implemented, the inner and outer setting, the individuals involved, and the process through which implementation is achieved) and highlighted their rich and complex relationship. Looking solely at the quantitative findings from the current study, the importance of inner setting is immediately evident regarding participants from the Heart of England NHS Foundation Trust. These participants all indicated that they would be able to implement the BeST intervention when completing their baseline questionnaires. However, organisational constraints later emerged that precluded any participants in this NHS Trust from implementing the BeST intervention. Looking to the qualitative findings provides further illumination of why some participants did not implement BeST.

Integration with qualitative findings

The thematic analysis highlighted several barriers to implementation that related to time constraints, aspects of the BeST intervention content, their scope of practice, patient selection, attitudes and beliefs of peers, patient factors and competition of services. Sanders et al (40) suggest that physiotherapists are well placed to deliver a psychosocial approach for the management of LBP due to the time they are able to dedicate to

communication. This suggestion is in contrast to the findings of this thesis, where time was a repeatedly cited barrier to the implementation of BeST and to the wider use of a CB approach. In a perspective article, Foster and Delitto (21) support the barrier presented by patient related factors as identified in this thesis, recognising the challenge that patient expectations and preferences can place on a clinician's treatment choice, which often encompass the need for a diagnosis and for hands on treatment.

The qualitative analysis also identified facilitators to implementation, namely the way BeST was 'packaged', providing a definitive structure for the implementation of the information. Clear guidance on how to implement a treatment following training has been identified by health care professionals as an essential attribute to training programmes (183). Foster and Delitto (21) describe the current ambiguity around how to integrate psychosocial perspectives into routine clinical practice and highlight this as a key challenge for implementation. This adds further support to the notion that clear guidance, such as that offered in the BeST package, can facilitate clinicians in the implementation of a psychosocial approach. Proactive managerial support was also found to be a facilitating factor, where management not only allowed study leave to complete the training, they also provided encouragement and support post-training during the implementation phase.

When considering longer term implementation (maintenance), participants were unsure if they would continue to implement the BeST intervention in their department and noted that if they did, they would need to modify it. Modifications would include changes to the patient assessment with regards to content and time, reducing the number of group sessions and increasing the exercise components. This highlights the importance of the adaptability of the evidence, a component of evidence that has been shown to influence implementation (32). Whilst it is essential that the evidence can be tailored to the local context, this process requires careful consideration of the 'core' components of the evidence in order to ensure fidelity and effectiveness (193).

Despite a number of participants failing to implement the BeST intervention, many described aspects of their clinical practice that had changed as result of the training. This could be explained by the behaviour change wheel proposed by Michie, van Stralen and West (194), which identifies three essential processes to achieve behaviour change: capability, opportunity and motivation (termed the COM-B system). According to this model, participants could have lacked the physical or social opportunity to deliver the intervention due to, for example, the previously identified barriers of organisational factors and the attitudes and beliefs of peers. Alternatively, they may have had the opportunity and motivation, and yet lacked the psychological capability, for example, through low self-efficacy, to deliver the intervention (194). Relating to motivation is the notion of intention to implement the BeST intervention. Although every participant stated that they would deliver the intervention on their baseline questionnaires, implementation intention was not formally measured. The qualitative data highlighted that a number of participants, despite completing and signing the postal baseline questionnaire and consent form, thought they had signed up for a study looking at training alone. Thus, participants may not have had the intention to implement the intervention in the first instance and thus, according to this model, may have lacked the required motivation (194).

In summary, the barriers and facilitators to implementation identified in this study are in line with the key domains of the Consolidated Framework for Implementation Research (CFIR) and reflect the complex, multifactorial nature of successful implementation. On the whole, the number of barriers considerably outweighed the presence of facilitators and may explain the low rate of implementation observed in the current study. Thus suggesting that whilst the provision of training with either method facilitated implementation for a proportion of the individuals in the trial, a more comprehensive strategy, addressing all five key domains in the CFIR, is required to achieve wider scale implementation.

9.2 Comparison of these findings to the literature

Efficacy of online learning

The systematic review (chapter two) found inconclusive evidence regarding the equivalent effectiveness of online, compared to face-to-face, training for health care professionals and identified only one study in the field of CBT. During the progression of this thesis, another relevant article (195) was identified that investigated the effectiveness of three methods (a written manual, online training and a two-day instructor led course) of training community mental health providers in Dialectical Behaviour Therapy (DBT; N=150). In contrast to the current study, the authors found comparable satisfaction between the web-based and instructor led training. Web-based participants also obtained significantly higher knowledge scores in comparison to the two remaining groups (195). The comparable satisfaction and greater knowledge scores could be attributed to several factors. Firstly, the compatibility of a technology with learners' norms and values has been identified as an important determinant of learner acceptance and engagement (59). Many of the physiotherapists in i-BeST found that sitting for long periods and learning through an online medium were stark contrasts to their usual practice, which may not have been the case for the mental health care providers here. Secondly, the course overview indicates that the degree of multimedia in the programme may have been substantially greater than in i-BeST, which could have improved learning outcomes (53).

The authors reported that all three training arms achieved comparable clinical competency assessed from a clinical role play. These competencies ranged from 1.44 to 1.76 out of 5, indicating that the health providers achieved only minimal competency according to their own classification scale. However, similarly to the study in this thesis, there was no benchmark data available to indicate what score would actually reflect clinical competency. The authors also identified several barriers to the implementation of DBT that were evident across all three training arms. These included a lack of clinical supervision and no formal

organisational commitment to implement DBT. They concluded that the online programme was the superior method of training; although they had no measures to indicate if any of the training strategies resulted in actual behaviour change.

In another study, published after the systematic review search period, Maloney et al (196) noted the sparse literature concerning the effectiveness of online learning for more complex interventions. Therefore, they evaluated the effectiveness of online versus face-to-face training for the prescription of falls prevention exercise. They classified this as a complex intervention since it incorporated a broad range of practical skills including decision making, hands-on skills and high-level communication. They included a range of health care professionals (n=135), with 92 completing the one-day face-to-face or 7-hour online training programme. Similarly to the physiotherapists in this thesis, some participants (28%) were apprehensive about learning with a web-based programme. However, they found no significant differences between the two groups following training, reporting comparable satisfaction (although face-to-face was slightly higher), knowledge scores and self-reported changes in clinical practice. As with Dimeff et al (195), the authors have no actual indication regarding the impact of the training on participants' clinical practice. A key difference to i-BeST was apparent in the methods used to deliver feedback in their online training course. Participants uploaded video footage of their skills, which was analysed by a web-based tutor who then provided feedback. Whilst this was thought to reduce feelings of isolation and enhance interactivity, it would have required considerable time from the trainer in comparison to the running of i-BeST.

The results from this thesis extend the findings from the systematic review in chapter 2 support the two studies (195, 196) described above with regards to the potential use of online training as a method to deliver knowledge to health care professionals pertaining to a complex intervention. However, the evaluation in this thesis did not find similar satisfaction ratings between online and face-to-face methods, suggesting that i-BeST may

be enhanced according to the strategies used in the above studies to improve on this variable. The efficacy of using online training to modify attitudes and beliefs has been sparely reported in the literature and was not reported in the two studies described above, or in any of the studies included in the systematic review. Thus, this thesis adds to this limited literature and suggests that the design features and content within the online programme used in this thesis may not achieve as great a change in attitudes and beliefs towards the management of LBP as seen in the face-to-face group.

Implementation literature

As with all of the studies included in the systematic review, Dimeff et al (195) and Maloney et al (196) did not train participants in concepts and skills deemed outside their traditional scope of practice, as was necessary for training physiotherapists in BeST. There is very limited literature regarding physiotherapists perspectives on being trained in, and experiences of implementing, CB techniques. In one of the first studies to explore this, Nielsen et al (171) interviewed eight physiotherapists about their perceptions of training in, and experiences of implementing, a cognitive-behavioural-informed intervention (pain coping skills training) for patients with knee osteoarthritis. The Australian participants were trained over a 3-4 day face-to-face workshop and had weekly clinical supervision from a psychologist for 3-6 months providing formal mentoring, role-play practice and performance feedback. Their thematic analysis revealed four key themes (training, experience of delivering the intervention, perspectives on the intervention, and physical therapist practice) that encompassed similar concepts to those identified in this thesis. In particular, their participants also reported that the CB-based intervention was very different to their usual practice. They found that, despite extensive clinical supervision, some participants felt they lacked the capacity to deal with complex patients and had concerns regarding their scope of practice.

On the whole, their participants reported positive improvements in their clinical practice as a result of their training. However, they found the topic of 'challenging thoughts' difficult and felt that they may not have had the necessary skills to teach this cognitive component competently. Similarly to the findings of the current study, they identified a number of barriers to the implementation of psychological interventions within physiotherapy practice. These included time constraints, dominance of the biomedical model in physiotherapy, peer knowledge, patient expectations, and fee structure. Participants also suggested, as with the current study, that they would modify the intervention for future use by selecting out various components to use. Further congruence in findings can be found from Sanders et al (40), who re-analysed 12 interview transcripts concerning physiotherapists' attitudes and beliefs towards the management of LBP. The authors found that physiotherapists lacked confidence to address the psychosocial aspects of LBP management, often feeling that they fell outside of their immediate scope of practice. They identified the presence of an unresolved conflict between the traditional biomedical and newer psychosocial clinical paradigms.

These findings by Nielsen et al (171) and Sanders et al (40) further support the difficulties observed in the current study regarding the integration of a CB approach into routine physiotherapy practice. The findings of Nielsen et al (171) show that even when extensive clinical support was provided post training, participants still identified many of the same anxieties and barriers as the physiotherapists studied in this thesis. Their findings also support the results from this thesis pertaining to implementation, suggesting that a more comprehensive strategy is needed to bridge the research-practice gap.

There is limited research concerning implementation strategies within the physiotherapy profession, with much of the literature based in the medical and nursing professions (197, 198). Advances in implementation science suggest that a multi-method strategy may

achieve greater implementation success, and that this may be further enhanced when tailored to barriers identified a priori (47, 199, 200). In a prospective cohort (N=94) Rebbeck et al (201) found that a multi-method implementation strategy resulted in a 21% increase in health care professionals compliance with clinical guidelines for whiplash. Their strategy consisted of an interactive educational workshop delivered by opinion leaders that was tailored to prospectively identified barriers. Since there was no control group, it was not possible to ascertain the effect of the implementation strategy against no intervention; thus, the influence of confounding variables on participants increased compliance cannot be ruled out. In addition, despite improved compliance with the guidelines, they found no significant improvements in patient outcomes.

In another example of a recent multi-method implementation strategy, Foster et al (202), evaluated the impact of implementing stratified care for LBP among general practices in the United Kingdom. Their implementation strategy combined educational sessions, regular audit, peer feedback and clinical mentoring. It was also supported by a real-time stratification tool, sub-grouping patients and providing risk group-matched treatment recommendations. The multi-method strategy and real time stratification tool improved risk-appropriate referrals for medium and high risk patients by 32% and significantly improved patient reported disability. However, similarly to Rebbeck et al (201), the study had no control group to provide comparative data. Additionally, the desired behaviour (appropriate referral) was relatively simple compared to the adherence of whiplash guidelines studied in Rebbeck et al (201).

Overall, there is inconclusive evidence regarding the use of single or multi-component strategies for modifying more complex behaviours, as required for the implementation of the BeST intervention (46, 198, 203). The results from this thesis have highlighted that a single component implementation strategy, through the provision of training, was not comprehensive enough to facilitate wider implementation of the BeST intervention. A

challenge that was further compounded by the complexity of training physiotherapists in a CB-approach; a new clinical paradigm for physiotherapists (20). However, both online and face-to-face training strategies did go some way towards achieving implementation and provide a good basis from which to develop future strategies.

9.3 Methodological considerations

Although the use of mixed methods both illuminated and expanded the study findings, there were a number of limitations that need consideration. These are discussed for the quantitative and qualitative components separately, before finally considering the overall mixed methods approach.

9.3.1 Considerations relating to the RCT

Firstly, there was no pre-specified sample size calculation and the sample included in this study was quite small. Despite this, statistically significant differences between the two groups were observed. However, due to the absence of a pre-specified sample size calculation, there is a degree of uncertainty in the interpretation of these significant findings. Additionally, where there was a lack of a significant difference between the two groups, these findings cannot be interpreted to mean that no such difference exists, only that with the small sample in this study, no evidence of a difference was observed (168). This is particularly important when interpreting the clinical competency scores which, due to the nature of the competency assessment, could only be obtained from participants implementing the BeST intervention. Since a limited number of participants implemented BeST, there is missing data regarding participant competence which may have affected the reliability and validity of this outcome. Nonetheless, the work is a very important step for determining sample size estimates for future work (204).

Secondly, it was not possible to assess competency with a blinder rater and thus the potential for bias cannot be ruled out (76). However, a second independent rater, blinded

to training allocation, analysed 25% of the competency recordings, reducing the potential influence of bias and ensuring validity of the scores. All remaining outcome measures were self-reported and completed by the individual participants. Thirdly, the knowledge test, self-efficacy and satisfaction questionnaires were self-developed and therefore their clinometric properties are not known, such as reliability and responsiveness.

Another important consideration is that by individually randomising participants, there may have been contamination of the implementation strategies at sites with multiple participants. For example, participants in the online-training may have discussed strategies with those in the face-to-face training if they had a question, resulting in possible contamination of intervention effects on learning outcomes. Although cluster randomisation would have avoided this limitation, there were too few clusters (205) and large variation the number of volunteers within each cluster.

The generalisability of the study results may be limited due to several factors. Firstly, the sampling strategy may have resulted in a biased sample (61). Since the participants volunteered to take part in this study, they may have been more motivated and interested in factors, such as the BeST intervention, CB approaches, online learning, or research itself (112), than the wider physiotherapy population. Secondly, due to the limited available resources and time frame for this thesis, participants were sampled from a restricted geographical area and only one face-to-face training workshop could be delivered. This may reduce the generalisibility of the results to the whole population of physiotherapists treating LBP. However, there was a good array of centres, encompassing both University hospitals and District General Hospitals, which reflect a range of locations where LBP treatment is frequently delivered. Thirdly, no patient outcome measures were collected and therefore, the study cannot add to the literature regarding the effect of training and implementation strategies on patient outcomes. Lastly, as previously identified,

implementation processes are dependent on key components related to the evidence, the health care professionals and the environmental context (59). Therefore, the findings of this study may not be generalisable to the implementation of other evidence-based interventions in and outside the field of physiotherapy.

9.3.2 Considerations relating to the case series

Whilst data from the case series participants is consistent with those observed in the RCT, no inferences can be drawn from the results due to the small numbers, a lack of randomisation and no comparison group. However, three case series participants contributed to the qualitative interview study and therefore, the case series chapter provides some contextual information for these participants.

9.3.3 Considerations relating to the qualitative interview study

Firstly, the initial aims of the interview study had been to ascertain the experiences of the online participants and to gain an understanding of participant training preferences. Therefore, no face-to-face participant was scheduled in the sampling framework to be interviewed. However, concurrent thematic analysis revealed a number of anxieties among online participants regarding the implementation of the BeST intervention. Therefore, responsive to the emerging themes in the data, face-to-face participants were invited for interview (163). Due to the time constraints in this thesis, only two face-to-face participants could be interviewed. Therefore, having only two participants to compare against produces substantial uncertainty in these comparisons and precludes any inferences that can be made (119).

A frequent criticism of qualitative research is the lack of generalisability of the results (100). Whilst the thematic analysis in this study did not aim to provide accounts applicable to large-scale populations, it is possible that the experiences reported in the interview study are not reflective of the whole study sample. The initial sampling framework was designed to capture a range of online participant variables. However, looking at the characteristics of

the online participants that were interviewed highlights that they were all classified as being more engaged with the online programme. Since this measure was not available prior to sampling, it could not be incorporated into the sampling framework that was initially used. Unfortunately, those that had been classified as being less engaged with the programme had failed to respond to invitations to attend an interview. Therefore, the reported experiences of the participants may not be transferrable to the whole sample of online participants (99). The sampling framework did however encompass a range of prior training preferences, satisfaction ratings and outcome measure scores.

Additionally, the majority of online participants reported an overall positive experience with i-BeST, and all participants spoke optimistically about the BeST intervention itself. Since the participants knew the interviewer was involved with the i-BeST study, it is possible that participants voiced more positive reflections to conform to or please the interviewer in an effort enhance their social desirability (119). However, all participants provided insightful negative feedback regarding the online course and the BeST intervention, suggesting that selective reporting did not bias the data.

It is also possible that the researcher's own interest and involvement with i-BeST may have influenced the participant-interviewer interaction, and the identification of themes (119). However, the researcher held no strong opinions or beliefs regarding the online course or the BeST intervention and remained reflective of their potential influence through the interview process and data analysis procedures. Transcripts were analysed critically and external guidance from an experienced qualitative researcher provided expansion and validation of themes. Additionally, the thematic analysis revealed a number of themes that did not stem from the interviewers questions. This suggests that the data truly reflects the experiences that were important to the participants and provides further validation of the findings (132).

Lastly, the timing of the interviews varied considerably in both the duration of time from completion of the training and in the stage of implementation of the BeST intervention. Therefore, participants interviewed at a later time point may not have recalled their training experiences as accurately. Conversely, these participants were more likely to have progressed with the implementation of the BeST intervention and therefore, may have provided more data pertaining to these experiences. Thus, the varied timings of the interviews may have influenced the qualitative data that was captured.

9.3.4 Limitations pertaining to the use of mixed methodology

Data were integrated during the interpretation stage of this study, drawing on quantitative and qualitative findings to understand training outcomes and the implementation of the BeST intervention. Using the results from both data sets to interpret each quantitative outcome provided a more substantial integration of the data than discussing the results of each study separately before considering integration (102). Further integration could have been achieved by integrating the data in the results stage, which may have enhanced the findings further and bought greater insight to the interpretations (100). Nonetheless, the integration provided a more comprehensive and meaningful understanding, of both the training outcomes and the implementation of BeST, than could have been achieved with either method alone. Thereby fulfilling the criteria of successful integration, where the combined account is 'more than the sum of the parts' (104).

9.4 Chapter summary

This discussion chapter has integrated both quantitative and qualitative data to interpret the results. A summary of the key findings are detailed below (Table 48).

Table 44. A summary of key findings from the mixed methods study

- Online participants identified a need to practice skills and obtain feedback.
- Whilst missing social interaction with their peers, online participants did not use the web-based forum.
- Face-to-face participants were more satisfied with the training they received.
- Online participants experienced a number of obstacles to learning online, which may account for lower satisfaction ratings.
- Prior training preference was linked to participant satisfaction but did not negatively impact on other study outcome measures in this sample.
- Online training did not achieve the same changes in attitudes and beliefs towards the management of persistent non-specific LBP patients as observed in the face-to-face group.
- Online training resulted in high knowledge scores that were similar to those achieved in the face-to-face group.
- According to the CTS-R-Pain classification scale, both methods resulted in a competency status of novice or advanced beginner, reflecting promising levels of competency in line with their training and experience with this treatment approach.
- Implementation of the BeST intervention was low in both training arms.
- Barriers to the implementation of the BeST intervention were linked to the use of a CB approach and included time constraints, anxieties around scope of practice, patient expectations, and a lack of confidence with some of the CB skills and topics.
- Patient selection, peer influence and competition of services were also identified as barriers to implementation.
- The comprehensive package and structure that BeST offered facilitated implementation, along with pro-active managerial support.
- The provision of training alone was an insufficient strategy to achieve wider implementation of the BeST intervention among physiotherapists in the NHS.

Chapter 10 - Final Discussion

This chapter will summarise the findings of this thesis with the following key questions:

- Should i-BeST be continued?
- How could i-BeST be improved?
- What could have been done differently in this first evaluation?

The chapter will conclude by identifying the contribution this thesis makes to the literature and with a discussion of suggestions for future research.

10.1 Should i-BeST be continued?

The results from this thesis suggest that online learning may be a feasible alternative to face-to-face training for providing physiotherapists with the necessary knowledge base related to the BeST intervention. Due to missing data from the competency assessments, no conclusions can be drawn regarding the efficacy of i-BeST for providing physiotherapists with the necessary clinical skills to deliver BeST and thus, this needs to be explored further in a large scale evaluation. The findings from this thesis have highlighted areas where the online programme needs to be enhanced, in particular to achieve greater changes in attitudes and beliefs and to improve user satisfaction. However, regardless of the training method, both strategies resulted in low uptake of the BeST intervention in clinical practice, highlighting the need to enhance either strategy when moving forward.

On the whole, the use of an online training method appeared to be acceptable to the physiotherapists studied in this thesis. Thus, in light of limited financial resources, coupled with the high demand for training in CB approaches against the ability to supply it (21, 43), i-BeST provides a possible avenue to pursue for the provision of at least some aspects of clinical training.

10.2 How could i-BeST be improved?

Irrespective of the method of delivery, the content of the training needs to be modified according to participants' reflections and feedback. In particular, there needs to be a greater focus on topics that were unfamiliar to the therapists. This should include content relating to thoughts and feelings, thought challenging, guided discovery, and using an exploratory questioning style. The training also needs to help physiotherapists gain a more comprehensive understanding of their clinical boundaries, so that they can feel confident discussing psychosocial aspects of their patients' pain, with the knowledge of when external referral is required. For both training strategies, there needs to be consideration of how the therapists can receive a form of clinician supervision to facilitate their skill development and build their confidence. Given the cost and limited availability of trainers, providing face-to-face clinical supervision would prove problematic on a larger scale. Thus, strategies to provide supervision could include synchronous or asynchronous web-based tutorials with a supervisor deemed competent in the delivery of BeST. This supervisor could take the form of a tutor or a more experienced peer, fostering the set-up of a peer support network. Alternatively, as used in Maloney et al (196), therapists could upload video clips of their clinical performance or role play rehearsals, which could then be audited and fed back to the clinicians.

Pertaining to the online training method, i-BeST could be improved both technically and in aspects of the content delivery according to participant feedback. A reoccurring suggestion was to provide more information on module learning times to help online learners plan and self-manage their time better. As advocated by the online learners in this thesis, evidence has shown that the use of video demonstrations enables the learner to 'model' skills, which is an important process in the transition of learning to applying knowledge (206). Therefore, the provision of video demonstrations should be expanded within the training, preferably in the format of multiple shorter clips over longer ones (183). Lastly, the online

training should be available in a CD/DVD format to allow departments to maintain their workforce skill set amidst staff leaving. This is particularly important in physiotherapy departments, where junior physiotherapists rotate after a specified period of time to gain experience across all areas of physiotherapy.

10.3 What should have been done differently with this first evaluation?

Firstly, i-BeST was piloted at the lead NHS site prior to the commencement of additional sites. Since these additional sites were established after i-BeST had essentially been produced, the minimum system requirements of i-BeST could not be matched to the new sites. Ideally, all sites would have been established prior to the development of i-BeST, enabling an assessment of the technical capabilities at each site (83). This would have ensured that the baseline minimum system requirements for i-BeST were in line with those available at all sites and prevented any problems relating to accessing the course. Secondly, whilst the study recruited to target, the high proportion of participants not delivering the BeST intervention resulted in missing competency assessments. Ideally, a greater starting sample size would have maintained higher numbers to assess the competency of therapists. Additionally, the evaluation of the implementation strategies did not use any guiding theoretical framework. Using a theory of behaviour change would have enabled various theoretical constructs to be measured thought to be important in behaviour change (207). This may have led to the identification of constructs responsible for the low rate of implementation. Lastly, this thesis did not include an economic analysis of both training strategies. This would have provided useful information to help guide future decisions regarding the costs of implementing both training methods.

10.4 Contribution

The notion that psychosocial approaches are needed for the management of persistent LBP is widely acknowledged (10, 17, 18). Despite this, research has not examined how physiotherapists should implement this new dimension to traditional physiotherapy into

routine clinical practice (40). Foster and Delitto (21) also acknowledge the lack of research investigating the integration of psychological approaches into routine clinical practice and highlight the many challenges that this presents. They advocate the use of innovative strategies to implement a CB approach into clinical practice and stipulate that high quality research is needed to test educational strategies. This thesis has addressed both of these recommendations and provides an essential piece of research within this sparse field. Output from this thesis, and the key contributions it makes to the literature, are detailed below:

- The systematic review in this thesis synthesised the evidence regarding the comparative effectiveness of online learning for health care professionals, and added to the limited evidence base concerning the use of online methods to train clinicians in complex interventions.
- The strategy used to produce i-BeST was drawn from a combination of the limited and often abstract guidance in this field. Publication of this strategy will provide a useful, practical guide for future researchers, educators and clinicians, who are novices in online learning and would like to disseminate their work online or create online resources.
- This thesis has added to the literature about the implementation of online training programmes for clinicians. Several intrinsic and extrinsic barriers to online learning were identified that are not reported in the online learning literature. The insight gained into these barriers will facilitate the successful design and implementation of future online training resources.
- This thesis has provided an important contribution to the limited implementation literature in the physiotherapy profession. This contribution falls across two interlinking themes: the complexities and processes of implementing an evidence-

based intervention into physiotherapists' routine clinical practice; and the challenges of integrating a CB approach into physiotherapists' clinical practice.

- Importantly, this thesis has identified a number of barriers and facilitators to the implementation of the BeST intervention within this professional group and context. This provides an essential foundation on which to build future implementation strategies and, as recommended in the literature, offers potential for these future strategies to be tailored (32, 199). Additionally, a number of these barriers will provide prior insight into potential challenges when considering the implementation of other evidence-based interventions into physiotherapy practice.
- Lastly, the online course produced in this thesis, i-BeST, provides a sound platform that can be enhanced and used to develop future dissemination strategies and further online resources.

10.5 Recommendations for further research

10.5.1 Development of i-BeST

Future work should refine i-BeST based on the feedback and experiences of the participants studied in this thesis. In addition to modifying aspects of the course delivery and presentation, online strategies to train clinicians in the more practical aspects of the BeST intervention, such as the use of exploring questions, need careful attention. Insight could be drawn from online programmes that have successfully trained clinicians to use motivational interviewing, a skill that utilises an exploratory style of questioning (for example, (208)). In addition, the use of video multimedia should be expanded to facilitate greater modelling of skills, as detailed previously. Lastly, future research should investigate the possible mechanisms of achieving changes in attitudes and beliefs via an online medium to achieve efficacy on this variable.

10.5.2 Consideration for the integration of CB approaches into physiotherapy practice

Regardless of the selected training method, future research is needed to investigate new strategies to optimally train clinicians in the more cognitive components of a CB approach, such as identifying and challenging thoughts. This was consistently identified as a problem area for the therapists in this thesis, and by the limited published work in this field. If physiotherapists are to adopt and use a CB approach, they need to feel confident in their own knowledge and skills. Current methods of teaching these aspects do not provide therapists with this confidence.

10.5.3 Considerations concerning the implementation strategy

There are a number of avenues that warrant future attention concerning possible implementation strategies. Firstly, when considering the implementation of BeST within physiotherapy, a more comprehensive strategy is needed. This strategy should be tailored to address the barriers to implementation that have been identified in this thesis. For example, since the attitudes and beliefs of peers constituted one of the identified barriers, it would seem logical to use local opinion leaders as part of a multifaceted implementation strategy to try and address this challenge. Additionally, the BeST intervention itself could be further refined in consideration of these barriers to improve the likelihood of successful implementation. As advocated by Mitchie et al (209), it would be valuable to identify the core components of the intervention, enhancing its adaptability and thereby facilitating its integration into clinical practice. Lastly, physiotherapists need additional support and guidance in the selection of patients to receive the BeST intervention. Future implementation strategies need to consider this challenge and facilitate clinicians in their selection of appropriate patients, for example, through the use of clinical decision support tools or through using a stratified model of care such as the STaRT back tool (15).

Another consideration is the professional group to which the implementation strategy is targeted. This thesis only included physiotherapists within the NHS. Pincus and McCracken

(22) argue that the use of non-psychologists, with regards to training in and delivering psychological interventions, is a primary constraint on research in the field of psychological interventions for LBP. They suggest that health professions outside of psychology do not have the essential grounding in the background and skills required to successfully deliver psychologically-based interventions. However, since there is limited access to psychologists in primary care, alternative strategies are essential. Future work should evaluate the adoption of BeST across various professional groups that manage LBP patients. A potential direction for this would be to follow the model of extended scope practitioners, where health care professionals could specialise in the use of a CB approach following the necessary training. Furthermore, future implementation strategies should consider using psychological theory (210), such as the theoretical domains framework, to determine which constructs are acting as barriers to the implementation process and to identify relevant components of an implementation strategy to address these barriers (28, 194).

Lastly, there is a growing body of research investigating online psychological interventions delivered directly to patients for chronic pain conditions that have shown positive results (211). In the latest systematic review, Eccleston et al (212) synthesised results from 11 studies and found a small effect on pain (n=11) and a moderate effect on disability (n=5) in favour of the online interventions compared to active controls. At long term follow-up they noted a small effect on disability had remained. Therefore, the potential of delivering BeST directly to patients with online methods warrants consideration when contemplating future implementation strategies.

10.6 Conclusion

This thesis aimed to explore the dissemination and implementation of the BeST intervention and in doing so, developed an innovative online training programme that provides an avenue for large scale dissemination. The evaluation in this thesis has provided

useful information regarding the potential efficacy of i-BeST and has identified key areas of the intervention that need enhancing to maximise its potential effect across a range of learning outcomes. The use of mixed methodology provided invaluable illumination and expansion of quantitative results. Importantly, this shed light on a number of barriers to the implementation of BeST, advocating the need for a more comprehensive implementation strategy that addresses aspects of the research itself, in addition to organisational, cultural and therapist factors.

Ultimately, this thesis has highlighted that the implementation of evidence remains a very real challenge for researchers, and yet is essential to improve the quality of life for the growing population of LBP patients around the world. i-BeST offers a sound basis from which to build future implementation efforts, providing researchers with a viable option in a climate constrained by limited resources and time.

List of appendices

Appendix 1 Example search strategy

1. exp Computer-Assisted Instruction/ or computer assisted training.mp. (8209)
2. internet training.mp. (27)
3. exp Education, Distance/ (2226)
4. e-learning.mp. (680)
5. online training.mp. (86)
6. ((internet adj2 training) or (computer adj2 training)).mp. [mp=title, abstract, original title, name of substance word, subject heading word, protocol supplementary concept, rare disease supplementary concept, unique identifier] (2430)
7. ((online or web-based) adj2 training).mp. [mp=title, abstract, original title, name of substance word, subject heading word, protocol supplementary concept, rare disease supplementary concept, unique identifier] (227)
8. ((web or virtual or online or distance) adj2 (learning or training)).mp. [mp=title, abstract, original title, name of substance word, subject heading word, protocol supplementary concept, rare disease supplementary concept, unique identifier] (2136)
9. ((web or internet or computer) adj based adj2 (learning or training or teaching)).mp. [mp=title, abstract, original title, name of substance word, subject heading word, protocol supplementary concept, rare disease supplementary concept, unique identifier] (906)
10. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 (13248)
11. exp Health Occupations/ (1208130)
12. exp Allied Health Personnel/ or exp Health Personnel/ or health professional.mp. (335093)
13. 11 or 12 (1450278)
14. 10 and 13 (6139)
15. patient$.mp. or exp Patients/ (4030899)
16. 14 not 15 (4762)
17. patient education.mp. or exp Patient Education as Topic/ (70250)
18. 16 not 17 (4762)
19. medical students.mp. or exp Students, Medical/ (26885)
20. 18 not 19 (4399)
21. randomized controlled trial.pt. (318743)
22. controlled clinical trial.pt. (83442)
23. randomized.ab. (223980)
24. placebo.ab. (128186)
25. clinical trials as topic.sh. (157633)
26. randomly.ab. (162018)
27. trial.ab. (231031)
28. 27 or 28 or 29 or 30 or 31 or 32 or 33 (804032)
29. exp animals/ not humans.sh. (3660845)
30. 28 not 29 (734427)
37. 20 and 30 (240)

Appendix 2 Data extraction sheet

Study	**Participants**	**Intervention/control**	**Outcomes**	**Results**
Author (date): Country: Course: Aims: HPC group (setting):	N randomised (I; C): M age (SD): Male, n (%): Level of training: Recruitment:	N groups: **Intervention:** Time: Staff: Teaching methods: Framework: pedagogical approach; psychological/learning theories **Control:** Time: Staff: Teaching methods: Framework: pedagogical approach; psychological/learning theories	Assessment: **Effects:** Outcome defined (measured, reported) (knowledge etc) **Process:** Outcome defined (measured, reported) (satisfaction; adherence) **Resources:** (time) (Costs: development/delivery)	N analysed (total (I;C)): N missing: Effects; time, data type (n,m(SD)) I: C: Process; time, data type (n,m(SD)) I: C:

Appendix 3 Reasons for exclusion in systematic review

Study	Reasons for exclusion
Beckley (2000)	A 'no intervention' control group was used
Cook (2005)	Insufficient data was presented in to enable data extraction and synthesis of results
Davis (2007)	Intervention not a clinical skill (evidence based medicine)
Durkin (2008)	Intervention and control were both internet/computer based
El Saadawi (2010)	Intervention and control were both internet/computer based
Elgie (2010)	A 'no intervention' control group was used
Ferlitsch (2002)	Intervention ineligibly (simulator) and a 'no intervention' control group was used
Gerbert (2002)	A 'no intervention' control group was used
Hadley (2010)	Intervention not a clinical skill (evidence based medicine)
Horiuchi (2009)	Intervention not a clinical skill (evidence based medicine)
Irvine (2007)	A 'no intervention' control group was used
Kulier (2009)	Intervention not a clinical skill (evidence based medicine)
Larsen (2009)	Intervention ineligibly (simulator)
Nyamathi (2010)	Intervention and control were both internet/computer based
Platz (2010)	Intervention was blended (internet and face-face learning)
Reed (2008)	Study sample ineligible (students)
Schwid (2001)	Intervention ineligibly (simulator)
Seymour (2002)	Intervention ineligibly (virtual reality training)
Towbin (2007)	Intervention ineligibly (simulator)
Tsai (2004)	No comparable control group – completed unrelated and separate training
van Boxell (2003)	Intervention ineligible (video conference of live lecture)

Appendix 4 The Cochrane Effective Practice and Organisation of Care (EPOC) 'risk of bias' assessment tool

Cochrane Effective Practice and Organisation of Care Group. Available from: http://www.epoc.cochrane.org (accessed 1 August 2011).

Nine standard criteria for RCTs:

Was the allocation sequence adequately generated?
Score "Yes" if a random component in the sequence generation process is described (eg referring to a random number table). Score "No" when a non-random method is used (eg performed by date of admission). CCTs and CBAs should be scored "No". Score "unclear" if not specified in the paper.

Was the allocation adequately concealed?
Score "Yes" if the unit of allocation was by institution, team or professional and allocation was performed on all units at the start of the study; or if the unit of allocation was by patient or episode of care and there was some form of centralised randomisation scheme, an on-site computer system or sealed opaque envelopes were used. CBAs should be scored "No". Score "unclear" if not specified in the paper.

Were baseline outcome measurements similar?*
Score "Yes" if performance or patient outcomes were measured prior to the intervention, and no important differences were present across study groups. In RCTs, score "Yes" if imbalanced but appropriate adjusted analysis was performed (e.g. Analysis of covariance). Score "No" if important differences were present and not adjusted for in analysis.** If RCTs have no baseline measure of outcome, score "Unclear".**

Were baseline characteristics similar?
Score "Yes" if baseline characteristics of the study and control providers are reported and similar. Score "Unclear" if it is not clear in the paper (e.g. characteristics are mentioned in text but no data were presented). Score "No" if there is no report of characteristics in text or tables or if there are differences between control and intervention providers. Note that in some cases imbalance in patient characteristics may be due to recruitment bias whereby the provider was responsible for recruiting patients into the trial.

Were incomplete outcome data adequately addressed?*
Score "Yes" if missing outcome measures were unlikely to bias the results (e.g. the proportion of missing data was similar in the intervention and control groups or the proportion of missing data was less than the effect size i.e. unlikely to overturn the study result). Score "No" if missing outcome data was likely to bias the results. Score "Unclear" if not specified in the paper (Do not assume 100% follow up unless stated explicitly).

Was knowledge of the allocated interventions adequately prevented during the study? *
Score "Yes" if the authors state explicitly that the primary outcome variables were assessed blindly, or the outcomes are objective, e.g. length of hospital stay. Primary outcomes are those variables that correspond to the primary hypothesis or question as defined by the authors. Score "No" if the outcomes were not assessed blindly. Score "unclear" if not specified in the paper.

Was the study adequately protected against contamination?
Score "Yes" if allocation was by community, institution or practice and it is unlikely that the control group received the intervention. Score "No" if it is likely that the control group received the intervention (e.g. if patients rather than professionals were randomised). Score "unclear" if professionals were allocated within a clinic or practice and it is possible that communication between intervention and control professionals could have occurred (e.g. physicians within practices were allocated to intervention or control)

Was the study free from selective outcome reporting?
Score “Yes” if there is no evidence that outcomes were selectively reported (e.g. all relevant outcomes in the methods section are reported in the results section). Score “No” if some important outcomes are subsequently omitted from the results. Score “unclear” if not specified in the paper.

Was the study free from other risks of bias?
Score “Yes” if there is no evidence of other risk of biases

Appendix 5 Example of an individual study's assessment of bias - Hugenholtz et al (2008)

Domain	Description	Review authors' judgement
Adequate sequence generation	P's were 'randomly assigned to four different groups in order of arrival at the meeting, by means of a four block randomisation system.'	Was the allocation sequence adequately generated? UNCLEAR
Allocation concealment	As above.	Was allocation adequately concealed? UNCLEAR
Equal baseline outcome measures	Baseline scores of both knowledge tests (X and Y) did not differ significantly (X mean=52.0, SD=9.2; Y mean=51.5, SD 8.1).	Are baseline outcome measures of study and control groups reported and similar? UNCLEAR Comment: The mean scores actually correspond to the baseline mean of test X (I and C groups) and test Y (I and C groups) and therefore does not inform of any differences between the groups.
Equal baseline characteristics		Are baseline characteristics of study and control groups reported and similar? YES
Complete outcome data	None lost to FU.	Were incomplete outcome data adequately addressed? YES
Blinded outcome assessment	P's were unaware that two teaching approaches were compared during the meeting.	Were primary outcome/s assessed blindly? Knowledge: YES
Protected against contamination	Individuals were randomised, though were unaware of an alternative teaching method. Intervention was on-off 30 minutes.	Was it unlikely the control group could have received the intervention? YES
Free from selective outcome reporting.	Only knowledge is described in the methods, and this is reported in the results.	Are reports of the study free of suggestion of selective outcome reporting? YES
Free from other sources of bias.		Was the study apparently free of other problems that could put it at a high risk of bias? YES

Appendix 6 Individual study results

Bello (2005) results

		Intervention		Control	
Outcomes	**Time**	**N**	**Median**	**N**	**Median**
Knowledge	Baseline	28	13.5	28	12.0
	48 hr FU	28	30.5	28	29.0
Practical skills	Baseline	28	31.5	28	32.5
	48 hr FU	28	46.0	28	47.0
Satisfaction	Baseline	28	n/a	28	n/a
	48 hr FU	28	10.0	28	9.0

Beyea (2008)

		Intervention		Control (small group)		Control (lecture)	
Outcomes	**Time**	**N**	**% passed**	**N**	**% passed**	**N**	**% passed**
DizzyFIX	Baseline	8	25	8	0	9	33
	7/7 FU	6	100	6	50	5	60
PRM	Baseline	8	12.5	8	0	9	22.2
	7/7 FU	6	83.3	7	87.5	7	28.6

Transformed data: The dichotomous outcomes for Beyea have been converted into continuous outcomes by giving a value to all those who passed (score of 4) and all those who failed (score of 1) and then calculating the mean scores for each group, below:

		Intervention			Control (small group)			Control (lecture)		
Outcomes	**Time**	**N**	**M**	**SD**	**N**	**M**	**SD**	**N**	**M**	**SD**
DizzyFIX	**Baseline**	8	1.75	1.39	8	1	0	9	2	1.5
	7/7	6	4	0	6	2.5	1.64	5	2.8	1.64
PRM	**Baseline**	8	1.38	1.06	8	1	0	9	1.67	1.32
	7/7	6	3.5	1.22	7	3.14	1.46	7	3.57	1.13

Chenkin (2008)

		Intervention			Control			Weighted mean difference	Standardised mean difference
Outcome	**Time**	**N**	**M (%)**	**SD**	**N**	**M (%)**	**SD**		
Knowledge	Baseline	11	52.8	13	10	54.5	8	-1.50 (-7.45, 4.45)	-0.21 (-1.07, 0.65)
	2/52 FU	11	78.8	7.3	10	80.3	6.6		
Practical skills	Baseline	11	n/r	n/r	10	n/r	n/r	-2.80 (-8.73, 3.13)	-0.37 (-1.24, 0.49)
	2/52 FU	11	75	9.3	10	77.8	3.6		

Downs (2006)

		Intervention	Control		
Outcome	**Time**	**Number (%)**	**Number (%)**		
Dementia detection rate	Baseline	43 (80)	47 (69)		
	9/12 FU	11 (20)	21 (31)	**Weighted mean difference**	**Standardised mean difference**
Outcomes	**Time**	**Mean (SD)**	**Mean (SD)**		
Diagnosis concordance score	Baseline	3.1 (2.4)	3.2 (2.4)	0.10 (-1.68, 1.88)	0.05 (-0.88, 0.98)
	9/12	3.6 (1.4)	3.5 (2.4)		
Management concordance score	Baseline	2.5 (1.7)	2.5 (1.7)	-0.80 (-2.14, 0.54)	-0.52 (-1.47, 0.43)
	9/12	1.5 (1.4)	2.3 (1.5)		

Fordis (2005)

		Intervention		Control		Weighted mean difference	Standardised mean difference
Outcomes	**Time**	**N**	**Mean (SD)**	**N**	**Mean (SD)**		
Knowledge	Baseline		Contacted authors		Contacted authors	n/a	n/a
	12/52	44	Contacted authors	49	Contacted authors	n/a	n/a
Screening	5/12 prior I	17	94.5 (3.8)	19	95.3 (6.6)	2.30 (-1.88, 6.48)	0.34 (-0.31, 1.00)
	5/12 post I	17	94.3 (5.2)	19	92.0 (7.5)		
Treatment	5/12 prior I	17	85.3 (9.2)	19	87.0 (8.4)	4.40 (-0.97, 9.77)	0.51 (-0.16, 1.18)
	5/12 post I	17	90.3 (5.7)	19	85.9 (10.3)		

Hugenholtz (2008)

		Intervention *a*		Intervention *b*		Control *a*		Control *b*	
Outcome	**Time**	**N 37**	**M (SD)**	**N**	**M (SD)**	**N 35**	**M (SD)**	**N**	**M (SD)**
Knowledge	Baseline		50.9 (8.3)		53.2 (8.6)		55 (10.0)		49.7 (7.4)
	Post		64.9 (9.2)		65.3 (10.2)		63.8 (7.3)		64.9 (10.5)

Or, with knowledge test X and Y means added together, the number of P's is now known (shown below; Cochrane formula for combing groups was used, section 7.7). Both intervention groups and both control groups received the same interventions; they took the tests in reverse order to each other.

		Intervention		Control		Weighted mean difference	Standardised mean difference
Outcome	**Time**	**N**	**M (SD)**	**N**	**M (SD)**		
Knowledge	Baseline	37	52.08 (8.42)	35	52.27 (9.04)	0.75 (-3.54, 5.04)	0.08 (-0.38, 0.54)
	Post I	37	65.12 (9.59)	35	64.37 (8.97)		

Makinen (2006)

		Intervention		Control	
Outcome	**Time**	**N**	**M (SD)**	**N**	**M (SD)**
Practical skills	2/52 post I	20	26.1 (nr)	16	28.9 (nr)

Paladino (2007)

		Intervention		Control		Weighted mean difference	Standardised mean difference
Outcome	**Time**	**N**	**M (SD)**	**N**	**M (SD)**		
Knowledge	Baseline	24	17.7 (3.1)	25	16.4 (4.5)	1.60 (0.17, 3.03)	0.61 (0.04, 1.18)
	Post I	24	19.4 (1.7)	25	17.8 (3.2)		

Sholomskas (2005)

The summative means and standard deviations presented for CBT skills (below) have been calculated by averaging the individual item mean scores and standard deviations from the YACS questionnaire, to give the total mean scores.

		Intervention (web plus manual)		Control (manual only)		Standardised mean difference	Weighted mean difference
Outcome	**Time**	**N**	**M (SD)**	**N**	**M (SD)**		
Knowledge	Baseline	24	36.3 (5.6)	25	36.6 (4.8)	0.28 (-0.28, 0.84)	1.9 (-1.86, 5.66)
	4/52 FU	24	40.2 (7.1)	25	38.3 (6.3)		
CBT skills	Baseline	24	2.13 (1.12)	27	1.82 (0.88)	0.25 (-0.31, 0.81)	0.35 [-0.42, 1.12]
	4/52 FU	24	3.08 (1.43)	25	2.73 (1.33)		
	4/12 FU	22	3.63 (1.45)	21	2.58 (1.32)	0.74 (0.12, 1.36)	1.05 [0.22, 1.88]

		Intervention (web plus manual)		Seminar plus supervision		Standardised mean difference	Weighted mean difference
Outcome	**Time**	**N**	**M (SD)**	**N**	**M (SD)**		
Knowledge	Baseline	24	36.3 (5.6)	27	36.0 (4.9)	-0.03 (-0.58, 0.52)	-0.20 (-3.59, 3.19)
	4/52 FU	24	40.2 (7.1)	27	40.4 (4.9)		
CBT skills	Baseline	24	2.13 (1.12)	27	2.02 (1.08)	-0.47 (-1.03, 0.09)	-0.69 [-1.48, 0.10]
	4/52 FU	24	3.08 (1.43)	27	3.77 (1.45)		
	4/12 FU	22	3.63 (1.45)	24	3.87 (1.73)	-0.15 (-0.73, 0.43)	-0.24 [-1.16, 0.68]

The authors analysed their results to investigate two comparisons: the seminar plus supervision group versus the manual only group; and the web plus manual (the intervention group) versus the manual only group. Thereby, not comparing the web plus manual group to the seminar plus supervision group. The group means and standard deviations were reported for all outcomes, enabling comparison across all three groups. The scores for each individual item of the YACS scale were used to calculate the overall group mean score for CBT practical skills and then to calculate the standardised mean difference (effect size) of the intervention.

Xiao (2007)

		Intervention		Control	
Outcome	**Time**	**N**	**No. compliant cases**	**N**	**No. compliant cases***
Practical skill	March-June (04)	19	14	31	12

* authors have joined 'no intervention' control group with the paper-based control group, therefore, it is not possible to identify how many compliant cases there were in the paper based control group also.

Appendix 7 The University of Warwick Learning and Development Centre: Example tools

(http://www2.warwick.ac.uk/services/ldc/resource/b9/exampletools/

Type of tool	Warwick tools	Tools beyond Warwick	Examples
Blogs and Microblogs	Warwick Blogs	Wordpress Twitter	IAPP blog Modes of reading Personal blog
Forums	Warwick Forums	Linoit Voicethread	Linoit Voicethread
Notepads		Evernote	
Online assessment	Quizbuilder QuestionMark Perception	Hot potatoes	Sitebuilder quiz QuestionMark Perception Hot potatoes • The Aschcombe School • Athenaze Greek Exercises • Lecture comprehension
Podcasts, videos and screencasts	Sitebuilder tools Echo 360/Lecture Capture	Jing Audacity Audioboo	Student podcasts Human rights iTunesU
Presentations	Sitebuilder slideshow	Prezi Slideshare	Prezi • How is the digital age changing your academic practice? • A knotty problem Slideshare
Shared documents		Google Drive	
Social bookmarking		Delicious Pinterest	Delicious Pinterest – Technology Enhanced Learning
Social networking		Facebook	Library Facebook page
Webinars	Webex	Skype	
Wikis		PBworks Wikia	PBworks – Language Centre Wiki Wikia - Philsophy Wiki Although you can't create a wiki with sitebuilder you can give others edit rights OSL technology wiki
Online course	Sitebuilder Moodle • Guides and training	Coursesites GLOmaker Xerte	Sitebuilder • Demo project management course Moodle - features demo Coursesites - Instructional Design GLOmaker - Examples XERTE - Example

Appendix 8 i-BeST feedback form

Overview

- How did you find navigating around the course?

  Were there any difficulties you experienced?

  Was there anything you liked about it?

- How easy was the course to use?

  Were there adequate instructions provided?

  What else (if anything) might have been helpful?

- Did you like the structure of the course?

  If not, please explain why below:

- Did you experience any difficulties with the text size/links/videos etc?

  If yes, please detail below:

- Please summarise the main problems you experienced with the course (if any):

- Please summarise the main strengths (if any) of the course:

- How would you rate the course overall on a scale of 1-10, with 1 being very poor and 10 being excellent?

Content

- Did you think the content was appropriate?

  If not, please detail your thoughts below:

- Was the depth of content adequate?

- If not, what would you like to have seen included?

- Did you feel anything was missing from the content?

- What did you like about the content?

- What did you not like about the content?

- Did you feel the content was organised in a logical way?

Media

- Were the slides aesthetically pleasing?

  Please detail things you liked or did not like:

- Was there enough variety in the presentation of content?
- What would you like to see more of?
- What would you like to see less of?
- Would you like to have heard more audio on the slides, for example, narration?

Tests

- Did you find the mini tests useful?

  If not, why?

- Did you feel the content of the final test was appropriate?
- Please comment below if you any further comments/suggestions regarding the mini or final tests:

Sessions

- Did you find the sessions easy to follow?

  If not, why?

- Could you navigate around each session easily?
- Did you find the video links useful?
- Did you find the video of example sessions useful?
- Is there anything else that would have been helpful?

Time

- How long did it take you to complete the whole course?
- Did you feel this was an appropriate amount of time?

Please use the space below to detail anything else you have noticed or can think of to improve the course:

Appendix 9 RCT participant information sheet

Warwick Medical School
CLINICAL TRIALS UNIT

i-BeST

Participant Information Sheet

Training Health Care Professionals to deliver a cognitive behavioural intervention for low back pain: a randomised controlled trial.

THE UNIVERSITY OF WARWICK

Randomised Controlled Trial

Training Health Professionals – a comparison of two methods.

You have been invited to take part in a research study. Before you decide, it is important for you to understand why the research is being done and what you would have to do. Please take the time to read the following information carefully. Feel free to talk to others and to ask us any questions you might have. Thank you for reading this. Our contact details are:

Helen Richmond
Email: Helen.richmond@warwick.ac.uk
Tel: 024 7615 0988

What is the purpose of the study?

A great deal of money is invested in researching new treatments for medical conditions. Not all of these new treatments can be easily used by health care professionals without additional training. This study is concerned with training health professionals to deliver an evidence based treatment for patients with sub-acute or chronic low back pain, called BeST[1]. The BeST treatment consists of an individual patient assessment and six group treatment sessions (one per week) that use a cognitive behavioural approach to the management of low back pain.

Providing a face-to-face course would be the traditional method of training health professionals to deliver BeST. This method of training has several limitations when looking to deliver it on a wide scale, particularly in relation to the cost of both producing and attending the training, along with limited course spaces and inconvenient geographical locations. Using the internet to deliver such training could enable greater numbers of Health Care Professionals to be trained at a much lower cost. This study will test how easy it is to find Health Care Professionals to take part in the study. It will also tell us what the Health Care Professionals think of the training methods and provide some idea of whether the internet training method will be a feasible alternative to the face to face training method.

1. *Lamb et al (2010) Group cognitive behavioural treatment for low-back pain in primary care: a randomised controlled trial and cost-effectiveness analysis. Lancet, 375: 916–23.*

Why have I been invited to take part?

You have been invited because you are a health care professional who treats patients with low back pain.

Do I have to take part?

It is up to you to decide whether or not to take part. If you decide to take part, you are free to withdraw at any time and without giving a reason. If you do decide to take part, you will be asked to sign a consent form to say that you agree to take part.

What will taking part involve?

If you decide to take part in the study, we will ask you to sign a consent form and complete a short questionnaire to obtain information such as your age and how long

you have been qualified for. Once we have received these from you, we will allocate you to one of two groups, either an internet-based training group or a face-to-face training group. This is done using a computer. The computer randomly chooses which training method you will receive, similar to tossing a coin. In this study you have an equal chance (50:50) of receiving either of the two training methods. The reason we need to do this is that we do not know if both training methods are as good as each other and so we need to compare them. This is called a randomised controlled trial. The decision is made by the computer and cannot be changed, so you have to be happy to accept either training method.

If you are allocated to the face to face training group, you will need to attend a 1.5 day face-to-face training course held at the University of Warwick and delivered by a physiotherapist specialising in cognitive behavioural therapy. You will also have access to a website where you can download guides and materials.

The training will be on: 14th and 15th May 2013

You must be able to make the training on this date if you are allocated to this group.

If you are allocated to the internet-based training group, you will be provided with log-in details to access the online course (i-BeST). The online course consists of the same content as that of the face to face course, but presented in a different format. You will be asked to start the course within two weeks of receiving the log in details. Once you have started the course, you will have three weeks to complete it.

Regardless of which group you are allocated to, you will be required to deliver the BeST intervention (individual patient assessments followed by six group sessions) to the appropriate patients once you have completed the training. If you have any colleagues in your department who are also taking part in the study, we ask that you do not discuss the training or the BeST intervention with them to avoid this affecting the study results.

Immediately following the completion of training in both groups, you will be asked to complete a multiple choice knowledge test, rate your satisfaction with the training and your confidence to deliver the treatment (BeST). Within three months of the completed training, one treatment session (selected by the computer) will be audio recorded for each health care professional. This recording will be analysed to measure how well key items were performed. We will also ask you to rate your confidence to deliver the BeST treatment again. This will be the end of the study.

You may also be asked if you would like to be interviewed about being in the study after you have taken part. You will be given information about the interview during study and can make a separate decision about whether you want to be interviewed after the training is finished.

Expenses and Payments
We are unable to pay for any expenses incurred during this study. However, refreshments and lunch will be provided for those attending the face-to-face training.

What are the possible benefits/disadvantages to taking part?
If you choose to take part in this study you will receive free training in an evidence based intervention (BeST) which you can then use in routine clinical practice. The knowledge and skills gained from this training will be transferrable to many different conditions that you may treat and can therefore be applied across your clinical practice.

There are no known or identified risks with either on-line or face-to face training. Therefore, taking part in this study should not pose any risks to the health care professionals.

Would my participation in this study be kept confidential?
Yes. All information which is collected about you during the course of the study will be kept strictly confidential.

During the study, data will be stored in the clinical trials unit at the University of Warwick and will be accessed only by the research team. After the study the data will be kept for five years, after which it will be destroyed.

It will not be possible to identify you from any published material arising from the study.

What happens at the end of the study?
When you have finished the training and the assessments detailed above you will have finished the study. You will be informed when the results of the study are available should you wish to receive a copy.

What if new information becomes available?
Should any new information relevant to either training method become available during the study, we will inform and discuss this with you. You will then be able to decide whether you wish to continue in the study or to withdraw.

What will happen if I don't want to carry on with the study?
You can stop taking part in the study at any point without giving a reason.

What will happen to the results of the research study?
The data collected will be analysed and the results will be used to write a research report and articles for other health professionals. In any report or publication we will not use your real name, and will not give any details that could identify you.

Who is organising and funding the research?
The person responsible for the research is Helen Richmond from the University of Warwick. The work is being conducted as part of a fellowship funded by the West Midlands Strategic Health Authority.

Who is being paid for this research?
You, or the researchers, will not receive any form of payment for taking part.

Who has reviewed this Study?
This study has been reviewed and given favourable opinion by the University of Warwick's Biomedical and Scientific Research Ethics Committee (BSREC).

What if I have any concerns?
Should you wish to make a complaint about the way you have been dealt with during the study, please address your complaint to the person below who is a senior University Official entirely independent of the study:

Nicola Owen
Deputy Registrar
Deputy Registrar's Office
University of Warwick
Coventry
CV4 8UW
T: 024 7652 2713
E: Nicola.Owen@warwick.ac.uk

What do we do next?
If you have decided you would like to take part in the study please complete the consent form to say that you are happy to take part and the questionnaire provided with this information sheet. Once completed, please return the forms in the pre-paid envelope provided.

Contact for further information:
If you have any questions about any aspect of the study or your participation in it, please contact:

Helen Richmond
Research Fellow
Warwick Clinical Trials Unit
Division of Health Sciences
University of Warwick
Coventry
CV4 7AL
T: 024 7615 0988
E: Helen.richmond@warwick.ac.uk

If I am not able to take your call, please leave a message and I will call you back.

Thank you for taking the time to read this information and for considering whether or not to take part.

Appendix 10 Example of feedback for one participant from the group audio recording

Overall this was a really good attempt at a difficult session. Well done, stick at it, explaining a lot of these concepts gets much easier every time you do it. Also, using an exploring questioning approach is new, as soon as you feel flustered or the patients don't say what you expect, you'll tend to drift back into teaching mode. This is completely expected and what most people experience. Table One provides feedback in key domains pertinent to the BeST intervention.

Table One

Key domain	Comments/Feedback
Agenda setting & Adherence	You did well in clearly stating the agenda at the beginning of the session. You adhered to the agenda in that you reviewed the last session, delivered the current content and set the relevant homework. There were some difficulties evident, namely with regard to time and the balance of content. Additionally, whilst BeST is a manualised intervention with a pre-set agenda, it is important to ask patients if they are happy with the suggested agenda. For example, you could ask: Does this sound okay to everyone? Is there anything that you'd like us to cover today? People sometimes bring up good questions or ask about things that are covered in other sessions, at this point use your judgement about whether you need to tweak the content of the session or ask if it can wait until the appropriate session.
Feedback	Good use of summarising at the beginning of the session, particularly regarding baseline and goal setting (from both yourself and in asking the patients to summarise back to you). However, feedback/summarising was not used much whilst delivering the content for the current session (you give a brief summary at the very end). Feedback was sought at the end of the session regarding the pace of the session and how the patients found the session which was good, though they were not given time to answer.
Collaboration	Good collaboration evident during the review of last week's session (first 20-30 minutes). Your style of delivery became more didactic towards the second half of the session. You tended to talk over patients. Good effort made to involve the group and get them to problem solve for each other.
Pacing and efficient use of time	Session over-ran by ten minutes. Too long spent on review of last week's session (20 minutes) and on thought identification. Thought challenging skill were not introduced or practised until over an hour into the session. Not enough time spent on thought challenging and homework setting.

Interpersonal effectiveness	Patients bring up some upsetting thoughts/feeling but these are often not acknowledged.
Eliciting of appropriate emotional expression	You were good at getting patients to express their emotions, but didn't deal with them or acknowledge them in some cases. One patient commented that they were 'Not normal' (with reference to their 95 year old mother having to carry their bag), and said 'I've given up'. The patient was quite upset, but this was not acknowledged. Other patients could have interpreted this to mean that emotional expression is not appropriate in the group. Advice for a similar situation should it arise in the future: You could have said 'I can see that's really upset you, I'm sorry you're upset. I suppose it's the reality of what we're dealing with, being in pain and not being able to do the things that we want to do is upsetting. Back pain is not nice!' You could also ask other people in the group if they've ever felt the same and how they got themselves through feeling that fed up with their back pain. The group would have helped you here; they have lots of experience of living with back pain between them. This could have led to a nice discussion about when it's appropriate to go to the GP with low mood. Another tip: you could have used her thought of 'I've given up' as a thought to challenge in the next bit (she's not given up; she's in your session!).
Eliciting key pain-relevant cognitions	Since the recorded session was number 3, many pain cognitions were identified providing lots of opportunities for linking them with feelings and behaviours. However, many times these opportunities were missed. For example, one patient states that they often think that their back is going to snap, though they knows it's not going to, they always think it will. You responded by saying that's interesting. This would have been a good thought to identify as a thinking error and even use it as an example for the thought challenging section.
Eliciting pain management behaviours	You identify some behaviour (following the session plan) but these are often not/or are weakly linked back to their pain.
Guided discovery	You were able to use some exploring questions but this was very limited in terms of guided discovery. Guided discovery helps the patient to develop hypotheses about their situation and to generate potential solutions. Effective guided discovery creates doubt where previously there was certainty. (this is difficult and will improve with practice)

Developing a cognitive-behavioural conceptualisation of the patients' pain-related distress and disability	You go over the CB model of LBP at the end of the session and add in thoughts/feelings to the model. This could have been emphasised more and integrated into the session more.
Application of change methods	This session is concerned with identifying and challenging thoughts. On the whole you were good at identifying them with patients but weaker at challenging them. Thus patients may not have found new perspectives or experienced a shift in their emotions as a result of the thought challenging that was practised. Whilst you did a good attempt at challenging thoughts, some of the examples you ended up using may not have been the most appropriate to help you demonstrate the process with patients. For example, an inappropriate thought was selected for a worked example of thought challenging. You selected a patients thought of 'I should get off the sofa' after sitting down for 30 minutes. This could be a positive thought (unless in reference to the boom/bust cycle) and not a negative thought (NAT). Therefore, by using this thought, the answer back thoughts are not very useful (it made the exercise difficult for you to get the point across to them). There were other more appropriate thoughts to use, e.g. the one mentioned earlier about 'my back is going to break/snap'.
Homework setting	Whilst homework was set, the explanation was very rushed due to the session over running. Patients didn't have time to ask any questions.
Facilitating behavioural change	Good teaching on baseline setting during the session re-cap. You did get a bit lost going over the goals with the group, they were talking generally about what they wanted to work on. You could have used one example and got the group to make it into a SMART goal so that they were rehearsing the skill. Baseline setting with the patient doing leaflet flying, this is a good example of group problem solving but careful that when you do the sums you don't overestimate the baseline (e.g. 9.5 hours/3 and take a bit off you said would be 3 hours. 3 hours 10 minutes with 20% off would be more like 2.5 hours). Someone asked about staying the same time 'but do more each day' and you said that was ok. It might be for that person but this not consistent with a pain management approach where we tend to say that they incrementally go up by 10% ish once a week or fortnight and stay at that level before increasing again.

	You do try and say how thoughts link to behaviours during the session which is good, but this could be explained more clearly.
Supporting change	You do discuss the progression of exercise and adjustment of baseline activity outside of the programme, but progression and self-management could have been discussed more frequently.

Here is some further feedback that may help you in going forward that didn't fall into any of the items above:

- Goal setting: one patient said attitude change was a goal. Could have asked 'how would I know you had changed your attitude if I was watching you? What would I see you doing differently? She would have said something like 'not pushing myself so hard'. You could have asked for concrete examples of what that would have looked like, e.g. the floor getting a little messy before hovering. You could have then asked if you could have that as a goal because if she was able to do something different then her attitudes would have to shift (you can change beliefs to change the resultant behaviour, or change behaviours to change the beliefs).
- 'I can't sit to do vegetables' would have been a good statement to challenge in session. Ask the other patients…what do you think of that? Why can't you? Etc.
- Patient said they 'Over-clean/over do housework to overcompensate for all the stuff they don't get right/screw up in their life.' Tricky situation as sounds like something beyond our skills, however, you could have acknowledged what they had said with a comment like 'wow, sounds like you're quite hard on yourself'. Therefore acknowledging the difficulty; but you were right not to delve.
- The session plan advises to cover thinking errors in general and then to go over them in relation to back pain. If you think it would flow better (and help with time), you could modify the session content so that you ask patients to think of back pain examples whilst you are covering each unhelpful thinking style, i.e., to save doing it twice.
- Interesting discussion on thought 'it could be cancer'. You asked nicely about what evidence there is that it might not be cancer, you could have explored what evidence they have that it might be cancer. For example, they might have said something about on-going pain without a diagnosis and you could then ask the group what else could be causing the pain (link back to session 1 discussion on pain).

Generally, you managed to do some nice psycho-education. This could be stepped up to a more questioning approach to get patients questioning what they are thinking/doing. Again, you showed some good examples of group problem solving, but this could be stepped up further, getting the group to problem solve for each other. This was a really tricky session and your thought challenging skills will only continue to improve with practice, the same for the use of guided discovery. Both are difficult skills to grasp, but you have certainly made a good start.

Overall, this was a good first group, so well done!

Appendix 11 Patient information sheet pertaining to the group audio recording

Warwick Medical School

i-BeST

Training Health Care Professionals

Information for patients

Your therapist has invited you to take part in a back pain programme consisting of an individual assessment and six group sessions lasting up to 1.5 hours each.

I would like to assess the therapist running the groups, and to do so I will be recording the audio from **one** of the group sessions. It will not be possible to identify you from the recording. Once the therapist has been assessed, the recording will be destroyed.

The recording is for training purposes to assess the physiotherapist.

I wanted to check that you were happy for one of the group sessions that you may be in to be audio recorded. If so, please sign the consent form on the next page.

Thank your help and support,

Helen Richmond (Physiotherapist)
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Appendix 12 CTS-R-Pain scale

COGNITIVE THERAPY SCALE – REVISED - PAIN (CTS-R-PAIN)

ITEM 1 - AGENDA SETTING & ADHERENCE

Key features: To address adequately topics that have been agreed and set in an appropriate way. This involves the setting of discrete and realistic targets collaboratively. The format for setting the agenda may vary according to the stage of therapy - see manual.

Three features need to be considered when scoring this item:

(i) presence/absence of an agenda which is explicit, agreed and prioritised, and feasible in the time available;
(ii) appropriateness of the contents of the agenda (to stage of therapy, current concerns etc.), a standing item being a review of the homework set previously;
(iii) appropriate adherence to the agenda.

Mark with an 'X' on the vertical line, the level to which you think the therapist has fulfilled the core function. The descriptive features on the right are designed to guide your decision.

NB: Agenda setting requires collaboration and credit for this should be given here, and here alone. Collaboration occurring at any other phase of the session should be scored under Item 3 (Collaboration).

Competence level	Examples NB: Score according to features, not examples!
0	No agenda set, highly inappropriate agenda set, or agenda not adhered to.
1	Inappropriate agenda set (e.g. lack of focus, unrealistic, no account of patient's presentation, homework not reviewed).
2	An attempt at an agenda made, but major difficulties evident (e.g. unilaterally set). Poor adherence.
3	Appropriate agenda, which was set well, but some difficulties evident (e.g. poor collaboration). Some adherence.
4	Appropriate agenda, minor difficulties evident (e.g. no prioritisation), but appropriate features covered (e.g. review of homework). Moderate adherence.
5	Appropriate agenda set with discrete and prioritised targets, reviewed at the end. Agenda adhered to. Minimal problems.
6	Excellent agenda set, or highly effective agenda set in the face of difficulties.

ITEM 2 – FEEDBACK

Key features: The patient's and therapist's understanding of key issues should be helped through the use of two-way feedback. The two major forms of feeding back information are through general summary and chunking of important units of information. The use of appropriate feedback helps both the therapist to understand the patient's situation, and the patient to synthesise material enabling him/her to gain major insight and make therapeutic shifts. It also helps to keep the patient focused.

Three features need to be considered when scoring this item:

(i) presence and frequency, or absence, of feedback. Feedback should be given/elicited throughout the therapy - with major summaries both at the beginning (review of week) and end (session summary), while topic reviews (i.e. chunking) should occur throughout the session;
(ii) appropriateness of the contents of the feedback;
(iii) manner of its delivery and elicitation (NB: can be written).

Competence level	Examples NB: Score according to features, not examples!
0	Absence of feedback or highly inappropriate feedback.
1	Minimal appropriate feedback (verbal and/or written).
2	Appropriate feedback, but not given frequently enough by therapist, with insufficient attempts to elicit and give feedback (e.g. feedback too vague to provide opportunities for understanding and change).
3	Appropriate feedback given and elicited frequently, although some difficulties evident in terms of content or method of delivery.
4	Appropriate feedback given and elicited frequently, facilitating moderate therapeutic gains. Minor problems evident (eg. inconsistent).
5	Highly appropriate feedback given and elicited regularly, facilitating shared understanding and enabling significant therapeutic gains. Minimal problems.
6	Excellent use of feedback, or highly effective feedback given and elicited regularly in the face of difficulties.

ITEM 3 – COLLABORATION

Key features: The patient should be encouraged to be active in the session. There must be clear evidence of productive teamwork, with the therapist skilfully encouraging the patient to participate fully (e.g. through questioning techniques, shared problem solving and decision making) and take responsibility. However, the therapist must not allow the patient to ramble in an unstructured way.

Three features need to be considered: the therapist style should encourage effective teamwork through his/her use of:

(i) verbal skills (e.g. non-hectoring);
(ii) non-verbal skills (e.g. attention and use of joint activities);
(iii) sharing of written summaries.

NB: Questioning is a central feature with regard to this item, but questions designed to facilitate reflections and self discovery should be scored under Item 9 (Guided Discovery).

Competence level	Examples NB: Score according to features, not examples!
0	Patient is actively prevented or discouraged from being collaborative.
1	The therapist is too controlling, dominating, or passive.
2	Some occasional attempt at collaboration, but didactic style or passivity of therapist encourages passivity or other problems in the therapeutic relationship.
3	Teamwork evident, but some problems with collaborative set (e.g. not enough time allowed for the patient to reflect and participate actively).
4	Effective teamwork is evident, but not consistent. Minor problems evident.
5	Effective teamwork evident throughout most of the session, both in terms of verbal content and use of written summaries. Minimal problems.
6	Excellent teamwork, or highly effective teamwork in the face of difficulties.

ITEM 4 - PACING AND EFFICIENT USE OF TIME

Key features: The session should be well 'time managed' in relation to the agenda, with the session flowing smoothly through discrete start, middle, and concluding phases. The work must be paced well in relation to the patient's needs, and while important issues need to be followed, unproductive digressions should be dealt with smoothly. The session should not go over time, without good reason.

Three features need to be considered:

(i) the degree to which the session flows smoothly through the discrete phases;
(ii) the appropriateness of the pacing throughout the session;
(iii) the degree of fit to the learning speed of the patient.

Competence level	Examples NB: Score according to features, not examples!
0	Poor time management leads either to an aimless or overly rigid session.
1	The session is too slow or too fast for the current needs and capacity of the patient.
2	Reasonable pacing, but digression or repetitions from therapist and/or patient lead to inefficient use of time; unbalanced allocation of time, over time.
3	Good pacing evident some of the time, but diffuse at times. Some problems evident.
4	Balanced allocation of time with discrete start, middle and concluding phases evident. Minor problems evident.
5	Good time management skills evident, session running smoothly. Therapist working effectively in controlling the flow within the session. Minimal problems.
6	Excellent time management, or highly effective management evident in the face of difficulties.

ITEM 5 - INTERPERSONAL EFFECTIVENESS

Key features: The patient is put at ease by the therapist's verbal and non-verbal (e.g. listening skills) behaviour. The patient should feel that the core conditions (i.e. warmth, genuineness, empathy and understanding) are present. However, it is important to keep professional boundaries. In situations where the therapist is extremely interpersonally effective, he/she is creative, insightful and inspirational.

Three features need to be considered:

(i) empathy - the therapist is able to understand and enter the patient's feelings imaginatively and uses this understanding to promote change;
(ii) genuineness - the therapist has established a trusting working relationship;
(iii) warmth - the patient seems to feel liked and accepted by the therapist.

Competence level	Examples NB: Score according to features, not examples!
0	Therapist's manner and interventions make the patient disengage and become distrustful and/or hostile (absence of/or excessive i, ii, iii).
1	Difficulty in showing empathy, genuineness and warmth.
2	Therapist's style (e.g. intellectualisation) at times impedes his/her empathic understanding of the patient's communications.
3	The therapist is able to understand explicit meanings of patient's communications, resulting in some trust developing. Some evidence of inconsistencies in sustaining relationship.
4	The therapist is able to understand the implicit, as well as the explicit meanings of the patient's communications and demonstrates it in his/ her manner. Minor problems evident (e.g. inconsistent).
5	The therapist demonstrates very good interpersonal effectiveness. Patient appears confident that he/she is being understood, which facilitates self-disclosure. Minimal problems.
6	Excellent interpersonal effectiveness, or highly interpersonally effective in the face of difficulties.

ITEM 6 – ELICITING OF APPROPRIATE EMOTIONAL EXPRESSION

Key features: The therapist facilitates the processing of appropriate levels of emotion by the patient. Emotional levels that are too high or too low are likely to interfere with therapy. The therapist must also be able to deal effectively with emotional issues which interfere with effective change (e.g. hostility, anxiety, excessive anger). Effective facilitation will enable the patient to access and express his/her emotions in a way that facilitates change.

Three features have to be considered:

(i) facilitation of access to a range of emotions;
(ii) appropriate use and containment of emotional expression;
(iii) facilitation of emotional expression, encouraging appropriate access and differentiation of emotions.

Competence level	Examples NB: Score according to features, not examples!
0	Patient is under- or overstimulated (e.g. his/her feelings are ignored or dismissed or allowed to reach an unmanged pitch). Or the therapist's own mood or strategies (e.g. intellectualisation) adversely influences the session.
1	Failure to facilitate access to, and expression of, appropriate emotional expression.
2	Facilitation of appropriate emotional expression evident, but many relevant opportunities missed.
3	Some effective facilitation of appropriate emotional expression, created and/or maintained. Patient enabled to become slightly more aware.
4	Effective facilitation of appropriate emotional expression leading to the patient becoming more aware of relevant emotions. Minor problems evident.
5	Very effective facilitation of emotional expression, optimally arousing the patient's motivation and awareness. Good expression of relevant emotions evident – done in an effective manner. Minimal problems.
6	Excellent facilitation of appropriate emotional expression, or effective facilitation in the face of difficulties.

ITEM 7 – ELICITING KEY PAIN-RELEVANT COGNITIONS

Key features: To help the patient gain access to his/her cognitions (thoughts and assumptions) and to understand the relationship between these and their pain management behaviours (e.g., activity cycling). This can be done through the use of questioning, diaries and monitoring procedures.

Three features need to be considered:

(i) eliciting cognitions that are associated with unhelpful pain management behaviours (i.e. selecting key cognitions or hot thoughts);
(ii) the skilfulness and breadth of the methods used (i.e. Socratic questioning; appropriate monitoring, downward arrowing, imagery, role-plays, etc.);
(iii) choosing the appropriate level of work for the stage of therapy (i.e. automatic thoughts or assumptions).

NB: This item is concerned with the general work done with eliciting cognitions. If any specific cognitive or behavioural change methods are used, they should be scored under item 11 (change methods).

Competence level	Examples NB: Score according to features, not examples!
0	Therapist fails to elicit relevant cognitions.
1	Inappropriate cognitions and emotions selected, or key cognitions/emotions ignored.
2	Some cognitions/emotions (or one key cognition, e.g. core belief) elicited, but links between cognitions and pain management behaviours not made clear to patient.
3	Some cognitions/emotions (or one key cognition) elicited in a competent way, although some problems evident.
4	A number of cognitions and pain management behaviours (or one key cognition) elicited in verbal or written form, leading to a new understanding of their relationship. Minor problems evident.
5	Effective eliciting and selection of a number of cognitions/behaviours (or one key cognition), which are generally dealt with appropriately. Minimal problems.
6	Excellent work done on key cognition(s) and behaviours(s), or very good work done in the face of difficulties.

ITEM 8 – ELICITING PAIN MANAGEMENT BEHAVIOURS

Key features: To help the patient gain insight into the effect of his/her behaviours and planned behaviours with respect to the way they manage their pain. This can be done through the use of questioning, diaries and monitoring procedures. This item helps ensure that the therapy is fully integrated with the patient's environment.

Two features need to be considered:

(i) eliciting behaviours that are associated with increased pain related disability;
(ii) the skilfulness and breadth of the methods used (i.e. socratic questioning; appropriate monitoring, imagery, role-plays, etc.);

NB: This item is concerned with the general work done with eliciting behaviours. If any specific cognitive or behavioural change methods are used, they should be scored under item 11 (change methods).

Competence Level	Examples NB: Score according to features, not examples!
0	Therapist fails to elicit relevant behaviours.
1	Inappropriate behaviours focused on.
2	Some behaviours elicited, but links between behaviours and pain related disability not made clear to patient.
3	Some behaviours/emotions elicited in a competent way, although some problems evident.
4	A number of behaviours/emotions elicited in verbal or written form, leading to a new understanding of their importance in maintaining pain related disability. Minor difficulties evident.
5	Effective eliciting and selection of a number of behaviours/emotions, which are generally dealt with appropriately. Minimal problems.
6	Excellent work done on behaviours and emotions, or very good work done in the face of difficulties.

ITEM 9 - GUIDED DISCOVERY

Key features: The patient should be helped to develop hypotheses regarding his/her current situation and to generate potential solutions for him/herself. The patient is helped to develop a range of perspectives regarding his/her experience. Effective guided discovery will create doubt where previously there was certainty, thus providing the opportunity for re-evaluation and new learning to occur.

Two elements need to be considered:

(i) the style of the therapist - this should be open and inquisitive;
(ii) the effective use of questioning techniques (e.g. Socratic questions) should encourage the patient to discover useful information that can be used to help him/her to gain a better level of understanding.

Competence level	Examples NB: Score according to features, not examples!
0	No attempt at guided discovery (e.g. hectoring and lecturing).
1	Little opportunity for discovery by patient. Persuasion and debate used excessively.
2	Minimal opportunity for discovery. Some use of questioning, but unhelpful in assisting the patient to gain access to his/her thoughts or emotions or to make connections between themes.
3	Some reflection evident. Therapist uses primarily a questioning style which is following a productive line of discovery.
4	Moderate degree of discovery evident. Therapist uses a questioning style with skill, and this leads to some synthesis. Minor problems evident.
5	Effective reflection evident. Therapist uses skilful questioning style leading to reflection, discovery, and synthesis. Minimal problems.
6	Excellent guided discovery leading to a deep patient understanding. Highly effective discovery produced in the face of difficulties, with evidence of a deeper understanding having been developed.

ITEM 10 – DEVELOPING A COGNITIVE-BEHAVIOURAL CONCEPTUALISATION OF THE PATIENTS' PAIN-RELATED DISTRESS AND DISABILITY

Key features: The therapist should assist the patient in relating their beliefs concerning pain, activity and other related issues to the ways in which they manage their pain, and to pain-related distress. The patient should be helped to understand how their cognitions and associated behaviours may contribute to disability and distress, as a basis for considering change now and in the future. Psycho-education regarding key pain management models and concepts (e.g., fear – avoidance, activity cycling, biopsychosocial factors) is integrated into this process.

One key feature needs to be considered:
(i) is the extent to which clear links between cognitions, behaviours and resultant disability and distress are elucidated

Competence level	Examples NB: Score according to features, not examples!
0	Therapist does not enable the patient to understand how their cognitions are linked to behaviour and pain related disability or distress.
1	Relevant cognitions and behaviours are discussed, but they are not meaningfully linked to the patient's pain-related disability or distress.
2	Some linkage between cognitions, behaviours and resultant disability and distress are made, but important presenting issues (e.g., avoidance) are omitted.
3	Good linkage between cognitions, behaviours and idiosyncratic features of the patient's distress and disability is evident; but no (or minimal) psychoeducation regarding key pain management models / concepts is integrated.
4	The therapist effectively assists the patient to understand the links between their cognitions, behaviours and pain related disability / distress, integrating this with psycho-education on relevant pain management concepts where appropriate. Minor problems are evident.
5	Therapist skilfully assists the patient to understand the links between their cognitions, behaviours and pain related disability / distress, integrating this with psycho-education on relevant pain management concepts where appropriate. Minimal problems.
6	There is excellent work done in assisting the patient to understand the links between their cognitions, behaviours and pain related disability / distress. This is skilfully integrated with psychoeducation regarding relevant pain management models / concepts.

ITEM 11 - APPLICATION OF CHANGE METHODS

Key features: Therapist skilfully uses, and helps the patient to use, appropriate cognitive and behavioural techniques in line with the formulation. The therapist helps the patient devise appropriate cognitive methods to evaluate the key cognitions associated with distressing emotions, leading to major new perspectives and shifts in emotions. The therapist also helps the patient to both apply behavioural techniques in line with the formulation, and develop suitable plans to promote effective change. The therapist helps the patient to identify potential difficulties and think through the cognitive rationales for performing the tasks. The methods provide useful ways for the patient to test-out cognitions practically and gain experience in dealing with high levels of emotion. The methods also allow the therapist to obtain feedback regarding the patient's level of understanding of prospective practical assignments (i.e. by the patient performing the task in- session).

Three features need to be considered:

(i) the appropriateness and range of both cognitive methods (e.g. cognitive change diaries, continua, distancing, responsibility charts, evaluating alternatives, examining pros and cons, determining meanings, imagery restructuring, etc.) and behavioural methods (e.g. behavioural diaries, behavioural tests, role play, graded task assignments, response prevention, reinforcement of patient's work, modelling, applied relaxation, controlled breathing, etc.);
(ii) the skill in the application of the methods - however, skills such as feedback, interpersonal effectiveness, etc. should be rated separately under their appropriate items;
(iii) the suitability of the methods for the needs of the patient (i.e. neither too difficult nor complex).

NB: This item is not concerned with accessing or identifying thoughts, rather with their re-evaluation.

Competence Level	Examples NB: Score according to features, not examples!
0	Therapist fails to use or misuses appropriate cognitive and behavioural methods.
1	Therapist applies either insufficient or inappropriate methods, and/or with limited skill or flexibility.
2	Therapist applies appropriate methods, but major difficulties evident.
3	Therapist applies a number of methods in competent ways, although some problems evident (e.g. the interventions are incomplete).
4	Therapist applies a range of methods with skill and flexibility, enabling the patient to develop new perspectives. Minor problems evident.
5	Therapist systematically applies an appropriate range of methods in a creative, resourceful and effective manner. Minimal problems.
6	Excellent range and application, or successful application in the face of difficulties.

ITEM 12 - HOMEWORK SETTING

Key features: This aspect concerns the setting of an appropriate homework task, one with clear and precise goals. The aims should be to negotiate an appropriate task for the stage of therapy in line with the conceptualisation; to ensure the patient understands the rationale for undertaking the task; to test out ideas, try new experiences, predict and deal with potential obstacles, and experiment with new ways of responding. This item ensures that the content of the therapy session is both relevant to, and integrated with, the patient's environment.

There are three aspects to this item:

(i) presence/absence of a homework task in which clear and precise goals have been set;
(ii) the task should be derived from material discussed in the session, such that there is a clear understanding of what will be learnt from performing the task;
(iii) the homework task should be set jointly, and sufficient time should be allowed for it to be explained clearly (i.e. explain, discuss relevance, predict obstacles, etc.).

NB: Review of homework from the previous session should be rated in Item 1 (Agenda Setting)

Competence Level	Examples NB: Score according to features, not examples!
0	Therapist fails to set homework, or sets inappropriate homework.
1	Therapist does not negotiate homework. Insufficient time allotted for adequate explanation, leading to ineffectual task being set.
2	Therapist negotiates homework unilaterally and in a routine fashion, without explaining the rationale for new homework.
3	Therapist has set an appropriate new homework task, but some problems evident (e.g. not explained sufficiently and/or not developed jointly).
4	Appropriate new homework jointly negotiated with a clear goals and rationales. However, minor problems evident.
5	Appropriate homework negotiated jointly and explained well, including an exploration of potential obstacles. Minimal problems.
6	Excellent homework negotiated, or highly appropriate one set in the face of difficulties.

ITEM 13 – FACILITATING BEHAVIOURAL CHANGE

Key features: Patients may require discrete skills training in order to facilitate behavioural change. These skills or techniques can include communication skills, activity pacing and goal setting skills, time management, and general problem solving.

There is a typical framework to follow with skills training: rationale, instruction, demonstration/modelling, practice, feedback, rehearsal, and generalisation. These require an understanding of behaviour change and learning.

This item also includes, where appropriate, helping the patient devise and carry out appropriate behavioural experiments.

Three features need to be considered:

(i) the appropriateness and range of skills / techniques being taught in line with the shared understanding of the problem
(ii) the proficiency demonstrated in the training of skills / techniques
(iii) the suitability of the skill / technique for the needs of the patient (i.e. neither too difficult nor complex).

Competence Level	Examples NB: Score according to features, not examples!
0	Therapist fails to use or misuses appropriate skills training
1	Therapist trains the patient in either insufficient or inappropriate skills or techniques, and/or with limited proficiency or flexibility.
2	Therapist trains the patient in appropriate skills or techniques, but major difficulties evident.
3	Therapist trains the patient in a number of skills or techniques in competent ways, although some problems evident (e.g. framework for learning the skill incomplete).
4	Therapist trains the patient in a range of skills or techniques with proficiency and flexibility, enabling the patient to develop new perspectives. Minor problems evident.
5	Therapist systematically trains the patient in an appropriate range of skills or techniques in a creative, resourceful and effective manner. Minimal problems.
6	Excellent range and training, or successful training in the face of difficulties.

ITEM 14 – SUPPORTING CHANGE

Key features: Treatment should be aimed at developing self management. Within this context it is important that patients are able to maintain the changes gained in therapy or able to progress with their therapy independently. This can include strategies for managing threats to self management such as changes to work or 'flare-ups'.

Two features need to be considered:

(i) the appropriateness of strategies selected to maintain changes or progress independently
(ii) the appropriate complexity of the plan for the patient

Competence Level	Examples NB: Score according to features, not examples!
0	Therapist fails to consider strategies for maintenance of change
1	Therapist acknowledges but does not facilitate maintenance of change
2	Therapist acknowledges maintenance of change but encourages inappropriate strategies (e.g. ongoing therapy)
3	Therapist encourages use of strategies that are mostly appropriate for maintenance of change but no plan considered
4	Therapist facilitates use of appropriate strategies for maintenance of change and considers formulation of plan
5	Therapist facilitates formulation of clear plan and use of appropriate strategies for maintenance of change
6	Excellent facilitation of clear plan and use of appropriate strategies for maintenance of change or well done in the face of difficulties.

ITEM 15 – RECOGNITION OF PROFESSIONAL BOUNDARIES

Key features: Therapists need to recognise their own clinical professional boundaries and adhere to their scope of practice. Therapists should be aware of the referral options available to them and understand the process for accessing these referral sources. However, a lack of referral options should not negate the need for complying with professional scope of practice.

Two features need to be considered:

(i) the appropriateness of referrals (i.e. patient's problems appropriately identified as outside individual scope of practice and referral made to appropriate other professional / agency)
(ii) the skill in negotiating this referral with the patient

Competence Level	Examples NB: Score according to features, not examples!
0	Therapist fails to adhere to scope of practice
1	Therapist has no awareness of referral process but does not access when appropriate
2	Therapist shows some awareness of own limitations and sometimes responds with appropriate referral
3	Therapist shows some awareness of own limitations and mostly responds with appropriate referral
4	Therapist clearly identifies own limitations with appropriate referral but not always timely
5	Therapist clearly identifies own limitations with timely and appropriate referral
6	Therapist clearly identifies own limitations with timely and appropriate referral in the face of difficulties.

Appendix 13 PABS-PT (pain attitudes and beliefs scale for physiotherapists)

Pain Attitude & Beliefs Scale

Instructions:

The purpose of this list is to help us analyse how you, the therapist, approach the most common forms of back pain. We do not mean back pain resulting from a radicular syndrome, cauda equina syndrome, fractures, infections, inflammation, a tumour or metastasis. It is not our intention to test your knowledge of back pain. We would simply like to know how you approach the treatment of back pain. We are looking for your opinion only; the opinions of others are not relevant.

Scoring:

We would like you to indicate the level to which you agree or disagree with each statement. Please circle: 1='totally disagree', 2='largely disagree', 3='disagree to some extent', 4='agree to some extent', 5='largely agree', and 6='totally agree'.

THE PAIN ATTITUDE & BELIEFS SCALE FOR PHYSIOTHERAPISTS (Pre-training)

(1) Back pain sufferers should refrain from all physical activity in order to avoid injury…… 1 2 3 4 5 6

(2) Good posture prevents back pain…… 1 2 3 4 5 6

(3) Knowledge of the tissue damage is not necessary for effective therapy…….. 1 2 3 4 5 6

(4) Reduction of daily physical exertion is a significant factor in treating back pain… 1 2 3 4 5 6

(5) Not enough effort is made to find the underlying organic causes of back pain… 1 2 3 4 5 6

(6) Mental stress can cause back pain even in the absence of tissue damage …… 1 2 3 4 5 6

(7) The cause of back pain is unknown…..…… 1 2 3 4 5 6

(8) Unilateral physical stress is not a cause of back pain …… 1 2 3 4 5 6

(9) Patients who have suffered back pain should avoid activities that stress the back… 1 2 3 4 5 6

(10) Pain is a nociceptive stimulus, indicating tissue damage …… 1 2 3 4 5 6

(11) A patient suffering from severe back pain will benefit from physical exercise… 1 2 3 4 5 6

(12) Functional limitations associated with back pain are the result of psychosocial factors…… 1 2 3 4 5 6

(13) The best advice for back pain is: 'Take care' and 'Make no unnecessary movements'…… 1 2 3 4 5 6

(14) Patients with back pain should preferably practice only pain free movements… 1 2 3 4 5 6

(15) Back pain indicates that there is something dangerously wrong with the back…. 1 2 3 4 5 6

(16) The way patients view their pain influences the progress of the symptoms…….. 1 2 3 4 5 6

(17) Therapy may have been successful even if pain remains…… 1 2 3 4 5 6

(18) Therapy can completely alleviate the functional symptoms caused by back pain…… 1 2 3 4 5 6

(19) If ADL activities cause more back pain, this is not dangerous…… 1 2 3 4 5 6

(20) Back pain indicates the presence of organic injury…… 1 2 3 4 5 6

(21) Sport should not be recommended for patients with back pain…… 1 2 3 4 5 6

(22) If back pain increases in severity, I immediately adjust the intensity of my treatment accordingly…… 1 2 3 4 5 6

(23) If therapy does not result in a reduction in back pain, there is a high risk of severe restrictions in the long term…… 1 2 3 4 5 6

(24) Pain reduction is a precondition for the restoration of normal functioning…… 1 2 3 4 5 6

(25) Increased pain indicates new tissue damage or the spread of existing damage.. 1 2 3 4 5 6

(26) It is the task of the physiotherapist to remove the cause of back pain…… 1 2 3 4 5 6

(27) There is no effective treatment to eliminate back pain…… 1 2 3 4 5 6

(28) TENS and/or back braces support functional recovery…… 1 2 3 4 5 6

(29) Even if the pain has worsened, the intensity of the next treatment can be increased…… 1 2 3 4 5 6

(30) If patients complain of pain during exercise, I worry that damage is being caused…….. 1 2 3 4 5 6

(31) The severity of tissue damage determines the level of pain…… 1 2 3 4 5 6

Please return the questionnaire to:

Helen Richmond; Warwick Clinical Trials Unit; Division of Health Sciences; Warwick Medical School; The University of Warwick; Coventry; CV4 7AL.

Appendix 14 Post training knowledge test

End of training questionnaire

1. The CB Model states that it is our interpretation of an event that is important, not the event itself.
   True/False
2. When several people experience the same event, they are likely to have the same thoughts about the event.
   True/False
3. An individual's interpretation of an event can explain their reaction to it.
   True/False
4. How many levels of cognition does the CB model identify?
   2 ☐
   4 ☐
   3 ☐
5. Automatic thoughts are the middle level of cognition.
   True/False
6. CB therapists produce case formulations to identify and illustrate how automatic thoughts are a result of deeper underlying beliefs.
   True/False
7. These case formulations highlight vicious cycles of behaviour that patients can become stuck in.
   True/False
8. The CB model theorises that our thoughts lead to related feelings, which lead to resulting behaviours. These behaviours often reinforce the thoughts, maintaining the cycle.
   True/False

9. What style of questioning should you adopt when delivering the BeST intervention?

Probing	☐
Exploring	☐
Open	☐
Didactic	☐
Directive	☐

10. Identify the correct questioning style from the examples below:

- Do you think heavy lifting always leads to back pain? ☐
- If heavy lifting always led to back pain, no one would be able to lift anything would they? ☐

11. Identify the correct questioning style from the examples below:

- Can you see that if you rest it when it hurts, it will get stiff and weak? ☐
- When do you think the 'rest it' approach might not be helpful? ☐

12. Problem solving, questioning skills and a 'try it and see' policy are integral clinical skills for optimal delivery of the BeST intervention.

    True/False

13. Guided discovery is process of questioning to guide the patient to agree with your own way of thinking.

    True/False

14. How long do we advise you to spend with a patient during their assessment?

30 minutes	☐
60 minutes	☐
45 minutes	☐
90 minutes	☐

15. How many group sessions make up the BeST intervention?

- 6 sessions ☐
- 7 sessions ☐
- 4 sessions ☐
- 5 sessions ☐

16. How frequently should the group sessions run?

- As often as you would like ☐
- Twice weekly ☐
- Once per week ☐
- Every day ☐

17. Which sessions ask patients to complete homework?

- Group sessions 1-5 ☐
- Group sessions 1, 2 and 5 ☐
- Group sessions 1-6 ☐
- The assessment and group sessions 1-5 ☐

18. Why is homework so important in the BeST intervention? (tick all that apply)

- To prevent the patients from forgetting what they have learnt ☐
- To make sure they are proactive in self-managing their back pain ☐
- To achieve skill development through practice ☐
- To learn what they do and don't like ☐

19. What does the assessment aim to achieve? (tick all that apply)

- To identify a goal to get started on ☐
- To establish their level of exercise to start on ☐
- To discuss the spines anatomy ☐
- To discuss what structures are likely to be causing their pain ☐
- To identify any issues which may be obstacles to recovery ☐
- To explain how they pain links to biological damage in their back ☐

20. What skills are taught to patients in session one? (tick all that apply)

- Understanding pain ☐
- How to set goals ☐
- Unhelpful thoughts and feelings ☐
- The benefits of exercise ☐

21. What skills are taught in session two? (tick all that apply)

- How to set goals ☐
- Working out baselines ☐
- Pain fluctuations ☐
- Pacing ☐

22. What skills are taught in session five? (tick all that apply)

- Relaxation ☐
- When pain worries us ☐
- Coping with flare ups ☐
- Restarting feared movements or activities ☐

23. The BeST intervention aims to educate patients about their back pain and cycles of behaviour, and to provide them with the skills (both cognitive and behavioural) to tackle these cycles and modify their behaviour.

    True/False

THANK YOU FOR FILLING IN THE QUESTIONNAIRE

Please return to: Helen Richmond; Warwick Clinical Trials Unit; Division of Health Sciences; Warwick Medical School; The University of Warwick; Coventry; CV4 7AL.

Appendix 15 Post training self-efficacy assessment

Self-Efficacy Questionnaire

We would like to ask you some questions about how confident you feel to deliver the BeST intervention. Please answer the questions below as completely as you can:

1. Please rate how confident are you to perform the individual patient assessments for the BeST intervention? (Please mark a cross on the scale below)

Not confident Very confident

2. Please rate how confident are you to perform the six group sessions for the BeST intervention? (Please mark a cross on the scale below)

Not confident Very confident

3. Is there any particular session (1-6) that you feel less confident to deliver?
   Yes – Session ……
   No ☐

4. Is there a particular session (1-6) that you feel most confident to deliver?
   Yes – Session ……
   No ☐

5. If you answered 'yes' to either questions 3 or 4, can you explain why below?
   ……
   ……
   ……
   ……

THANK YOU FOR FILLING IN THE QUESTIONNAIRE

Appendix 16 Satisfaction questionnaire

Satisfaction Questionnaire

We would like to ask you the following questions to find out how satisfied you are with the training you received. Please answer the following questions as completely as you can:

1. Which training did you receive (face to face or online)?

   ……

2. How satisfied are you with the training?

   Very satisfied ☐

   Satisfied ☐

   Neither satisfied or unsatisfied ☐

   Unsatisfied ☐

   Very unsatisfied ☐

3. Was there anything you liked about the training?

4. Was there anything you did not like about the training?

5. What did you find most useful about the training?

6. Can you think of any ways in which to improve the training you had?

THANK YOU FOR FILLING IN THE QUESTIONNAIRE

If you have any questions please contact the study team:

Helen Richmond - Tel: 024 7615 0988 E: Helen.richmond@warwick.ac.uk

Appendix 17 SMD and 95% CI calculations

SMD calculation

SMD = $\frac{Difference\ in\ mean\ outcome\ between\ groups}{Pooled\ standard\ deviation}$

The formula for calculating SMD can be found in the Cochrane Handbook of systematic reviews: Higgins JaG, S. Cochrane Handbook for Systematic Reviews of Interventions: The Cochrane Collaboration; 2011. Available from: www.cochrane-handbook.org

Pooled SD was calculated using coden's d:

Pooled SD = $\sqrt{\frac{SD1^2+SD2^2}{2}}$

J. Cohen, Statistical Power Analysis for the Behavioural Sciences (second ed.)Academic Press, New York (1988)

95% CI for SMD

A 95% CI for the SMD = $SMD \pm 1.96 \times \sigma$

Where $\sigma = \sqrt{\frac{n_1+n_2}{n_1*n_2}} + \frac{SMD^2}{2(n_1+n_2)}$

Note: n_1 and n_2 denote sample sizes in each group

Formula provided Hedges and Olkin (1985) in Yang and Dalton (2012): Yang D, Dalton J, editors. A unified approach to measuring the effect size between two groups using SAS®. SAS Global Forum; 2012

Appendix 18 Interview participant information sheet

Warwick Medical School
CLINICAL TRIALS UNIT

i-BeST

Training Health Care Professionals to deliver a cognitive behavioural intervention for low back pain: a randomised

Interview Study

Information for participants

THE UNIVERSITY OF WARWICK

Interview study for i-BeST.

You have been invited to take part in an interview as part of the i-BeST study so that we can better understand your experience of undertaking the training and being involved in the trial. Before you decide, it is important for you to understand why the research is being done and what you would have to do. Please take the time to read the following information carefully. Please ask any questions you might have and we will try to answer any queries. Thank you for reading this. Our contact details are:

Helen Richmond
Email: Helen.richmond@warwick.ac.uk
Tel: 024 7615 0988

What is the purpose of the study?
Making research accessible to clinicians is important to ensure optimal patient care. The provision of training is a key component in enabling clinicians to learn new treatment methods. You have taken part in a trial comparing training methods and we want to find out what it has been like.

Why have I been invited to take part?
You have been invited because you have been involved in a training programme for a treatment for low back pain (i-BeST)

Do I have to take part?
It is up to you to decide whether or not to take part in an interview. If you decide to take part, you are free to withdraw at any time and without giving a reason. If you do decide to take part, you will be asked to sign a consent form.

What will taking part involve?
If you would like to participate in the study, you will be interviewed once by one of the research team. They will come and talk to you at your choice of venue. Interviews usually last for about one hour, but can be longer or shorter. During the interview, you will be asked about your experience of the trial and the training. If you don't mind, we will record the interview so that we don't have to write everything down and so we don't miss anything.

What are the possible benefits/disadvantages to taking part?
You are not likely to benefit in any way by taking part, but the information you give us will help us to improve training for clinicians such as yourself, and bring us closer to getting research into clinical practice. We do not anticipate any risks from your participation. Apart from the time required to take part in the study, we do not anticipate any inconvenience would be caused to you. Remember, you can stop at any time. Please feel free to contact us if you would like to discuss anything.

Would my participation in this study be kept confidential?
All information collected will be kept in the strictest confidence. We will never put your name on the interview. We will take great care not to use any information that would let other people know who you are such as the hospital you work at. Each interview will be typed out to make sure that we have not missed any important information. Only the research team will see your interview. Information from the interview will be kept securely. The recordings of the interviews will be securely stored for 5 years and then they will be deleted. You will not be able to be identified when the research results are written up into a report.

What will happen to the results of the interview study?
The data collected will be analysed and the results will be used to write a research report and journal articles. We will not use your real name, and will not give any details that could identify you, in any publication. If you would like to see the record of the interviews, we can send you a copy. If you do not want us to use any of your words, please tell us and we will remove them.

Who is organising and funding the research?
The person responsible for the research is Helen Richmond from the University of Warwick. The work is being conducted as part of a fellowship funded by the West Midlands Strategic Health Authority.

Who is being paid for this research?
You, or the researchers, will not receive any form of payment for taking part.

Who has reviewed this Study?
This study has been reviewed and given favourable opinion by the University of Warwick's Biomedical and Scientific Research Ethics Committee (BSREC).

What if I have any concerns?
If you have any concerns about this study or the way it is being carried out, you should contact:

Helen Richmond
Research Fellow
Warwick Clinical Trials Unit
Division of Health Sciences
University of Warwick
Coventry
CV4 7AL
T: 024 7615 0988
E: Helen.richmond@warwick.ac.uk

Or you may contact the person below who is a senior University Official entirely independent of the study:

Jo Horsburgh, Deputy Registrar, Deputy Registrar's Office, University of Warwick, Coventry, UK, CV4 8UW. T: +00 44 (0) 2476 522 713 E: J.Horsburgh@warwick.ac.uk

What do we do next?
The researcher carrying out the interviews (Helen Richmond) will contact you to see if you want to take part in an interview and if you have any questions. If you decide to take part then they will arrange a convenient time to interview you.

Contact for further information:
If you have any questions then please contact Helen Richmond who will carry out the interviews on telephone number: 02476 150988 or email: helen.richmond@warwick.ac.uk. If she is unable to take your call then please leave a message and we will phone you back.

Thank you for taking the time to read this information and for considering whether or not to take part.

Appendix 19 Example of a participant summary and reflections post interview

Summary of i-BeST226

This participant appeared to have a preference for face-to-face training as she felt that better reflected the clinical setting of the intervention and that she needed guidance, interaction and demonstrations that could only be delivered in a face to face format. She initially felt that is would not be possible to be trained in BeST via an online medium.

Her perceived preferred learning style, of being fed information and guided by a tutor, did not match up with reports of her actual experience, where she felt she was better learning independently so that she can go at her own pace and re-visit areas. She admitted being resistant to change and new ways of doing things and concluded that actually online may be a better way of training for her.

Her feedback on i-BeST was mixed – she really liked some aspects (the videos) and found the programme drew her in, kept her engaged and was practical. However, she found the navigation difficult at times and some of the titles and questions too ambiguous. She also felt that with no indication of progression though the whole course, it was difficult to plan and manage her time since she was not aware of how much remained. Whilst she said the online training was good, she felt she needed to practice verbalising a lot of the concepts and acknowledged that is was *how* questions were asked that was important.

She reported that completing the BeST training has impacted on her clinical practice hugely and that she now has better tools for explaining pain to patients, tries to be less directive when talking to patients and teaches them some of the new skills, such as pacing.

There appeared to be a number of barriers to implementing the groups in clinical practice, including competition from other departments/areas, anxiety both around patient selection and in the verbalisation of key concepts, and time constraints for both completing the assessments and for using an exploratory style of questioning. Issues of verbalisation were around both the style of delivery and in regards to some of the content, particularly thoughts and feelings.

This participant was highly motivated to do the training and viewed BeST as a fantastic intervention that would be hugely beneficial for their departments to use. Despite high levels of motivation, there appeared to be a number of barriers to actually completing this online training, and when considering future online training. These included the environment (work or home), concentration (avoiding distractions), commitment (sitting down to do it) and having the discipline to complete all the training and not 'cheat' (cutting corners where you can).

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